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(54) **Folding multi-purpose tool with floating springs**

Klappbares Mehrzweckwerkzeug mit schwimmend gelagerten Federn

Outil pliable universel à ressorts flottants

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(73) Proprietor: **Leatherman Tool Group, Inc.**
Portland, Oregon 97294 (US)

(72) Inventor: **Rivera, Benjamin C**
West Linn, Oregon 97068 (US)

(74) Representative: **Hoarton, Lloyd Douglas Charles**
Forrester & Boehmert,
Pettenkoferstrasse 20-22
80336 München (DE)

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to folding multipurpose tools, and in particular to such a tool which may include a pair of pliers and several different tool bits and blades and that can be folded small enough to be carried comfortably in one's pocket.

[0002] Folding knives and the like including blades or tool bits available to be unfolded from both ends of a handle have typically included springs in the back of the handle to hold each blade in its folded position or in its deployed position by pressing on the base of the blade. Not only does such a spring press against the base of a blade to hold it open or closed, but it also bears a considerable axially-directed load when a deployed blade or tool bit is used. For example, a knife acts as a lever tending to rotate about its pivot pin and a surface on the rear of the knife blade presses against an end of the spring.

[0003] Where a single spring is required to act upon tool members on both ends of a handle the spring has typically been held in place with respect to other parts of the handle by a rivet located centrally along the length of the handle.

[0004] The forces generated by use of a knife blade typically are fairly small, and small-diameter blade pivot pins and spring-holding fasteners are sufficient. Where pliers are supported by a pair of folding handles, however, the loads to be carried axially within a spring are potentially significantly greater. A rivet or other fastener holding or supporting a spring in a handle of such a tool would need to be larger, and a spring would need to have a correspondingly large area to receive such a fastener. For a tool including folding pliers and intended to be small enough to be carried in one's pocket, that type of construction would result in an undesirably large tool.

[0005] Folding multipurpose tools of many types have been available in recent years, but most such tools including pliers large enough to be fairly strong are rather bulky, heavy, and industrial in appearance. Manufacture of more compact tools, using a single spring for multiple blades, has required careful adjustment during assembly in order to have pliers jaws and other blades and tool bits fold and extend crisply and without undesirable amounts of free play or friction. Use of an individual spring for each blade or bit has resulted in loss of compactness, making a tool requiring a pair of handles undesirably bulky. Smaller tools including folding pliers have been comparatively weak and thus of limited utility.

[0006] In some previously available multipurpose tools including folding pliers, various tool blades are available only after having to separate a pair of handles to reach those tool blades.

[0007] What is desired, then, is a multipurpose folding tool having a pleasant appearance, which has adequate strength, which can be folded or opened easily yet which feels secure, which can be manufactured satisfactorily without extremely close tolerances, and yet which is light enough and compact enough when in a folded configuration to be carried comfortably in one's pocket.

[0008] European Patent Application No. 1023971 (Leatherman Tool Group, Inc.) discloses a multipurpose folding tool including several tools which fit close to the handles of the tool when the tool is in a folded configuration thereof. A spring in one handle keeps a corkscrew safely folded when not in use, and a brace on the base of the spring keeps it in a desired position relative to the handles. The spring in the handle is connected to one pivot shaft that passes through the body of the tool, and bears against the base of the corkscrew.

[0009] US Patent No. 4,837,932 (Elsener) discloses a pocket-knife having a blade which is pivotable between open and closed positions. The pocket-knife comprises a handle, the knife blade being pivotally mounted at one end of the handle, with a beam spring extending substantially along the length of the handle, and a locking device for locking the knife blade in the open position. The beam spring is pivotally mounted for limited rocking movement within the handle. The beam spring includes a recess for receiving a retractable locking member of the locking device, a projectional ratchet tooth co-operating with a locking member, and a cam guide incorporating with a tang portion of the knife blade to control the pivoting of the knife blade.

[0010] US Patent No. 1,701,467 (Tillmanns) discloses a pocket tool having a handle and a special corkscrew tool pivoted through the handle. A pair of springs extend along the tool, and are arranged so as to bear against the base of the corkscrew tool, which rotates about a point near the middle of the tool. Each spring also has at least one floating end which is configured to bear against the base of a further folding tool provided at at least one end of the pocket tool.

SUMMARY OF THE INVENTION

[0011] The present invention provides answers to the aforementioned needs for compactness, strength, and versatility in a multipurpose folding tool by providing a sub-assembly for a folding tool comprising: a first frame side member having a pair of opposite ends, an integral flange member extending laterally from said first frame side member; a pair of spaced-apart pivot axles extending through said first frame side member, each of said pivot axles being located near a respective one of said opposite ends of said first frame side member; and a tool member having a base attached to the first frame side member by a pivot joint separate from and located generally between said pivot axles, said tool member being movable about said pivot joint between two positions, and said base of said tool member having an engagement surface corresponding to one of said two positions and, characterised by a spring having a pair of opposite end portions each defining an opening through

which extends a respective one of said pivot axles, thereby supporting the end portions, and a central portion aligned with and biased into contact with said base of said tool member, said spring urging said tool member into said one of the two positions when said central portion is in contact with said engagement surface.

[0012] Advantageously, said central portion of said spring is spaced apart from said flange member and has clearance to move towards said flange member in response to movement of said base about said pivot joint.

[0013] Preferably, said base of said tool member has an additional engagement surface, a respective one of said engagement surfaces corresponding to each of said two positions, and wherein said spring urges said tool member into a selected one of said two positions wherein said central portion is in contact with said respective one of said engagement surfaces corresponding with said selected one of said two positions.

[0014] Conveniently, said tool member is a corkscrew.

[0015] Advantageously, said central portion of said spring is offset with respect to said end portions of said spring away from said flange member and toward said base of said tool member.

[0016] Preferably, said central portion of said spring is aligned with said flange portion.

[0017] Conveniently, said flange portion has an inner side and a pair of opposite end faces, said central portion of said spring is spaced apart from said inner side, and said end portions of said spring extend away from said opposite end faces of said flange portion.

[0018] Advantageously, the sub-assembly further includes a second frame side member.

[0019] Preferably, said first and second frame side members define a channel therebetween.

[0020] Conveniently, the sub-assembly further includes a second tool member, between said first and second frame side members.

[0021] Advantageously, the sub-assembly includes an elongate second spring separate from said frame side member and having a pair of opposite free ends said second spring resting against said flange member intermediate said ends, and said sub-assembly also including: a third tool member having a base and a force-resisting member, and wherein one of said free ends of said second spring rests against said force-resisting member said other of said free ends of said second spring rests against said base of said third tool member and said second spring is held between said first flange, said force-resisting member and said base.

[0022] The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0023]

FIG. 1 is a side view of a folding multipurpose pocket tool that is a preferred embodiment of the present invention, showing a pair of pliers in a deployed configuration and showing several other tool bits and blades in partially folded portions with respect to the handles of the folding tool.

FIG. 2 is a side elevational view of the folding tool shown in FIG. 1, taken from a first side thereof.

FIG. 3 is an elevational view of the folding tool shown in FIGS. 1 and 2, taken from the right end of FIG. 2.

FIG. 4 is a side elevational view of the other side of the folding tool shown in FIGS. 1 and 2.

FIG. 5 is an elevational view of the folding tool shown in FIGS. 1-4, taken from the right end of FIG. 4.

FIG. 6 is a top view of the folded tool shown in FIGS. 2, 3 and 4.

FIG. 7 is a partially cutaway view taken in the direction indicated by the line 7-7 in FIG. 1, showing one handle of the folding tool with the pliers jaws deployed.

FIG. 8 is a sectional view of the folded tool shown in FIGS. 2-6, taken along line 8-8 in FIG. 6.

FIG. 9 is a partially cutaway sectional view of the folded tool shown in FIGS. 2-6, taken along line 9-9 in FIG. 6.

FIG. 9A is a simplified sectional view of an alternative form of a frame side member and a spring of the tool shown in FIG. 9, taken on line 9A-9A.

FIG. 9B is a view taken in the same direction as FIG. 9A showing a pair of frame side members and springs in an alternative embodiment of the invention.

FIG. 9C is a view similar to FIGS. 9A and 9B showing another alternative embodiment of the invention.

FIG. 10 is a partially cutaway sectional view of the folded tool shown in FIGS. 2-6, with one knife blade deployed, taken along line 10-10 of FIG. 6.

FIG. 10A is a view similar to the upper portion of FIG. 10, showing a cork puller rotated through an angle away from its folded position.

FIG. 11 is a detail view, at an enlarged scale, showing a base portion of the knife blade shown deployed in FIG. 10, together with a portion of a spring acting on the knife blade as a lock to hold it in its deployed position.

FIG. 12 is an exploded view of components of the handle shown uppermost in FIG. 2, but without the tool members and blades shown in FIGS. 1-10.

FIG. 13 is a sectional view, at an enlarged scale, taken along line 13-13 in FIG. 6.

FIG. 14 is an end view taken in the same direction as FIGS. 3 and 13 showing the handles and pivot axles of the folded tool shown in FIG. 2 without the tool members and blades.

FIG. 15 is an end view similar to FIG. 14, showing the handles of a folding tool similar to that shown in FIG. 14 and embodying the invention but having fewer frame side members.

FIG. 16 is an end view similar to FIG. 15, showing the handles of a folding tool similar to that shown in FIG. 15 which is another embodiment of the invention.

FIG. 17 is an end view similar to FIGS. 14, 15, and 16, showing the handles of a folding tool which is another embodiment of the invention in which each handle has an interior frame member-including a channel and a single external frame side member in addition to the interior frame member.

FIG. 18 is an end view similar to those of FIGS. 14-17, showing the handles of a folding tool similar to that shown in FIG. 17, which is another embodiment of the invention.

FIG. 19 is an exploded view showing a portion of a partially-assembled folding tool embodying the present invention at a first stage of the procedure of assembling the tool.

FIG. 20 is a view similar to FIG. 19, showing parts of a handle for a folding tool which is a different embodiment of the invention, also at a first stage of the procedure of assembling the tool.

FIG. 21 is a partially exploded view of a portion of a partially-assembled folding tool according to the present invention at a later stage of assembly of the tool than is shown in FIGS. 19 and 20, illustrating the assembly of internal frame portions of the handles of the tool with a pair of pliers included as part of the tool.

FIG. 22 is a partially exploded view showing assembly of additional parts of a folding tool according to the present invention at a stage of the assembly procedure following that shown in FIG. 21.

FIG. 23 is a partially exploded view of a folding tool according to the present invention showing installation of handle scales on a nearly completely assembled tool.

FIG. 24 is a side elevational view of a folding tool according to the present invention showing the use of a cork puller included in the tool.

FIG. 25 is a view similar to FIG. 24, showing a further stage in the procedure of removing a cork from a bottle using the tool shown in FIG. 24.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Referring now to the drawings which form a part of the disclosure herein, a folding multipurpose tool 30 embodying the present invention is shown in FIG. 1. The folding tool 30 includes a pair of pliers including jaws 32 and 34 that cross each other and are interconnected by a pliers pivot joint 36, preferably secured by a rivet. While the pliers jaws 32 and 34 are of the long nose type and include gripping portions and wire cutter portions, it will be understood that other types of pliers jaws might also be included in such a tool instead, as might metal snip jaws or the like, within the limitations of available space. A pair of handles 38, 40 are attached, respectively, to the base portions 42, 44 of the pliers jaws 34, 32. As will be explained in greater detail subsequently, the pliers jaws 32 and 34 can be moved into stowed or folded positions with respect to the handles 38 and 40, and the folding tool 30 can be placed into a folded configuration shown in FIGS. 2, 3, and 4.

[0025] The folding tool 30 also includes several other tool members which can each be folded into a respective stowed or folded position within a respective one of the handles 38, 40, or unfolded into a deployed position. Because of their respective locations within the handles 38 and 40, some of the additional tool members shown in FIG. 1 can be folded or unfolded only when the pliers jaws 32 and 34 are at least partially removed from their stowed positions. That is, the Phillips® screwdriver 46 and the lanyard link 47, associated with the handle 40, and the medium screwdriver blade 48, the narrow screwdriver blade 50, and the wide screwdriver blade 52, associated with the handle 38, cannot be deployed from nor folded into their stowed positions when the pliers jaws 32 and 34 are in their fully folded positions and the handles 38 and 40 are in the position shown in FIGS. 2, 3 and 4, because those tool members all move into and out of stowage positions located on the interior side of the respective one of the handles 38 and 40, where the pliers jaws 32 and 34 are located when the folding tool 30 is in the folded configuration shown in FIGS. 2, 3 and 4.

[0026] Other tool members or blades are arranged to move into respective stowage positions on the opposite, or exterior, sides of the handles 38 and 40, and those tools thus are available to be opened to their respective deployed positions when the folding tool 30 is in the folded configuration shown in FIGS. 2, 3 and 4. Thus, the corkscrew 54, the combined bottle opener, can opener, and corkscrew brace 56, the file 58, and the serrated edge knife blade 60 are all available to be opened from their respective positions in the handle 38 when the folding tool 30 is in the folded configuration shown in FIGS. 2, 3 and 4.

[0027] Similarly, the awl 64, the drop point knife blade 66, the scissors 68, and the saw 70 are all available to be deployed when the folding tool 30 is in the folded configuration.

[0028] It will be understood that the arrangement of tool members and blades shown included in the folding tool 30 is but one of numerous possibilities, and fewer or different tool members and blades might be included in a folding tool such as the tool 30 without departing

from the spirit of the present invention.

[0029] Referring in particular to FIG. 2, it will be seen that on a first side of the folding tool 30 in its folded configuration, the combination can opener and corkscrew brace 56 and the corkscrew 54 are available to be opened from the handle 38, where a handle scale 72 has a shape leaving a large access opening 74 where the corkscrew 54 is located. The scale 72 may be of a desired decorative material such as a suitable plastic, wood, or metal, such as aluminum, which may be anodized or otherwise decorated. The scale 72 has rounded margins which cover the edges of the frame side member 180 to add comfort.

[0030] As may be seen in FIG. 3, a portion 73 of the corkscrew 54 protrudes laterally outward somewhat beyond the handle scale 72 at the location of the access opening 74, although its tip is safely located within the overall shape of the handle 38. The corkscrew 54 is attached to the handle 38 at a pivot joint 76 located near mid-length of the handle 38, as will be explained in greater detail subsequently. The can opener and corkscrew brace 56 is mounted on and can rotate about a pivot axle 77, which may be a rivet, as is shown in FIG. 3. A similar pivot axle 88 is located at the end of the handle 38 opposite the pivot axle 77.

[0031] Also readily available on the side of the folding tool 30 seen in FIG. 2, but located in the handle 40, is the drop point knife blade 66. A handle scale 78 includes an indentation 80 located centrally along its outer margin to provide easy access to a nail nick 82 in the knife blade 66.

[0032] The drop point knife blade 66 is mounted on a pivot axle 86, located at the opposite end of the handle 40 from the pivot axle 77 in the handle 38. Like the pivot axles 77 and 88, the pivot axle 86 may be a rivet. A similar pivot axle 84 is located at the end of the handle 40 opposite the pivot axle 86.

[0033] As seen in FIG. 4, the serrated knife blade 60 is mounted pivotably on the pivot axle 88, and includes a nail nick 82 aligned with the indentation 80 in the handle scale 78 of the handle 38. The scissors 68, mounted on the pivot axle 84, are available similarly in the handle 40, with a nail nick exposed in the indentation 80 in the margin of the scale 78 on that side of the handle 40.

[0034] Referring also to FIGS. 5, 6, 7 and 8, the pliers jaws 32 and 34 are housed in internal frame members 90 and 92, each including a pair of frame side members 94 and 96 interconnected by a centrally located flange portion 98, as may be seen clearly in FIG. 12 where the frame member 90 is shown separately. Each internal frame member 90, 92 thus includes a short channel portion facing openly inward toward the opposite one of the handles 38 and 40 when the folding tool 30 is in the folded configuration shown in FIGS. 2, 3, and 4. The flange portion 98 has a length 100 that is considerably shorter than the length between the opposite ends 102 and 104 of either frame side member 94 or 96.

[0035] The frame side members 94 and 96 are preferably reduced in weight by provision of lightening holes 105 in each frame side member.

[0036] A pair of springs 106 are located side by side between the frame side members 94 and 96 of each internal frame member 90 and 92. Each of the springs 106 has a pair of respective end portions 108 and 110 and a central portion 112. The central portion 112 is offset from the end portions 108 and 110 so that an abutment shoulder 114 is formed at each end of the central portion 112. Each abutment shoulder 114 faces toward the other, and a back side 116 of the central portion 112 faces toward the flange 100. The springs 106 are located so that each abutment shoulder 114 confronts a respective one of a pair of opposite end faces 118 of the flange portion 100, and the back side 116 of the central portion of each spring 106 rests against an inner side 120 of the flange 98.

[0037] In order to allow the springs 106 to flex as required for the pliers jaws 32 and 34 to move between their respective deployed configuration shown in FIG. 1 and the folded configuration of the folding tool 30, the distance between the abutment shoulders 114 is slightly greater than the length 100 of the flange 98. This provides a small clearance between the abutment shoulders 114 and the end faces 118 when the spring 106 is relaxed, with the clearance preferably being on the order of 0.1-0.2 millimeter.

[0038] A length 121 of each of the springs 106 is at least about equal to and preferably slightly greater than the center-to-center spacing between the pivot axles 77 and 88, or 84 and 86. The shape of the springs 106 is such that each is always at least slightly flexed, causing an elastic force biasing each end portion 108 against the respective base portion 42 or 44 of the pliers jaws 32 and 34. The back side 116 is biased against the respective inner side 120 of the flange 98, and the end portion 110 biased against a respective base portion of at least one tool member such as one of the screwdriver blades 46, 48, 50 or 52.

[0039] Each of the springs 106 includes a centrally located locator portion 122 protruding inwardly toward the interior of the channel portion of the respective internal frame 90 or 92 to limit the extent to which the pliers jaws 32 and 34 can move into the channel portion defined by each internal frame 90 or 92. The locators 122 prevent the pliers jaws 32 and 34 from intruding into the space required by the screwdrivers 46, 48, 50, and 52 within the handles 38 and 40.

[0040] When the pliers jaws 32 and 34 are in the folded, or stowed, position shown in FIG. 8, the end portions 108 of the springs 106 act on each base portion 42, 44 with elastic force to urge the pliers jaws 32 and 34 into their folded positions with respect to the handles 38 and 40, thus biasing the tool 30 into its folded configuration.

[0041] The pressure of the end portions 108 against the pliers base portions 42 and 44 and of the end portions 110 against the base portions of the screwdriver blades 46, 48, 50, and 52, keeps the central portion 112

of each of the springs 106 securely engaged with the flange 98. The back side 116 of each spring 106 presses against the inner face 120 of the flange portion 98, with the abutment shoulders 114 confronting the opposite end faces 118 of the flange 98, so that the springs 106 are securely retained within the respective internal frame 90 or 92, without having to be pinned or riveted to the handle frame side members 94 or 96 as in conventional folding knife construction.

[0042] Because of the stresses likely to be caused by use of the pliers the pivot axles 84 and 88 are of ample thickness, for example 0.125 inch in diameter, and each internal frame 90 and 92 is of strong material, and preferably steel, for example pressed sheet steel 1 millimeter thick.

[0043] Both the springs 106 and the internal frames 90 and 92 are preferably symmetrical about a transverse plane of symmetry, so that identical parts can be used as either internal frame 90 or 92 and can be assembled without concern for the direction of the ends 102 and 104 with respect to the end portions 108 and 110 of the springs 106.

[0044] As may be seen in FIGS. 7 and FIG. 8, the screwdriver blades 48, 50, and 52 have respective thumb-like projections 124, 126, and 128 to serve as nail catches for unfolding each screwdriver blade from its folded position. The projections 124, 126, and 128 are located at different distances from the pivot axle 77, separated from each other by a distance of preferably at least one or two millimeters so that any of the three screwdriver blades 48, 50, and 52 can easily be opened individually.

[0045] Because of the flexed condition of the springs 106, the end portions 110 of the two springs 106 ride on the peripheral surfaces of the base portions of the screwdriver blades 48, 50, and 52, causing friction sufficient to keep the screwdriver blades from falling freely open from their folded positions within the internal frame 90. Similarly, the end portion 110 of the spring 106 in the other internal frame 92 presses against the peripheral surface of the base portion of the screwdriver 46, with sufficient friction to keep the screwdriver blade 46 in its stowed position.

[0046] The peripheral surfaces, however, do not provide a camming action to urge the screwdriver blades 46, 48, 50, and 52 into their respective stowed positions. Instead, the base of each such screwdriver blade 46, 48, 50 or 52 may be shaped to act as a cam forcing the respective spring to flex more as the screwdriver approaches the fully folded or stowed position. Friction between the spring and the base of the screwdriver blade holds the screwdriver securely in its folded position, but the friction is partially overcome by the shape followed by the spring, which over a few degrees of movement from the fully folded position tends to urge the screwdriver blade away from the folded position by cam action, but with too little force to completely overcome friction. Accordingly, it is relatively easy to begin to move any of the screwdrivers 46, 48, 50, or 52 from their stowed positions.

[0047] Once any of the screwdriver blades moves more than a small angle from its fully stowed position, however, a cam lobe portion of the base portion of each screwdriver urges the end portion 110 of the spring or springs 106 outward, initially increasing friction and later allowing a catch arrangement to engage the fully deployed screwdriver blade, as will be explained in greater detail subsequently.

[0048] To provide the folding multipurpose tool 30 various additional capabilities besides the basic pliers jaws and screwdrivers shown in FIG. 8 and described immediately above, various numbers of external frame side members housing additional tool members and blades are located alongside the internal frames 90 and 92.

[0049] As shown in FIG. 9, for example, frame side members 130 and 132 are included as parts of the handles 38 and 40. A flange 134, integral with the frame side member 130, extends laterally inward toward the flange 98 of the internal frame 90 of the handle 38. A similar flange 136, integral with the frame side member 132, extends laterally inward toward the flange 98 forming the channel portion of the internal frame 92 of the handle 40. The flanges 134 and 136 are located on the interior sides of the handles 38 and 40, the sides of the handles 38 and 40 which are located close together when the folding tool 30 is in its folded configuration, as shown in FIG. 9. The frame side members 130 and 132 are identically similar to each other and are preferably symmetrical about a transverse central plane, so that they are interchangeable with each other. Additional similar frame side members 138 and 140 are also located respectively in the handles 38 and 40, between the internal frames 90 and 92 and the frame side members 130 and 132, respectively. Another similar frame side member 142 is included in the handle 40, as may be seen in FIG. 3, alongside the drop point knife blade 66. The respective flange 134, 136, etc. for each of the frame side members 130, 132, 138, 140, and 142, is preferably manufactured along with the respective frame side member 130, etc., by bending a portion of sheet metal blank. The frame side members 130, etc., and their flanges, 134, etc., may be made of an appropriate metal such as aluminum or other material, depending upon the strength required by the particular tool members associated therewith, although sheet steel is preferred, with weight reduced, if desired, by lightening holes 143.

[0050] Each frame side member 130, 132 and the like has a pair of opposite ends 144, and the flange 134, 136, etc. is located centrally along the frame side member and has a pair of opposite end faces 148.

[0051] An elongate beam spring 152 associated with each frame side member 130, 132, etc., has a pair of opposite end portions 154 and 156 and a central portion 158 which rests on the flange 134, 136, etc., engaging the end faces 148 with respective abutment shoulders

160. A back side 164 of the central portion 158 rests against an inner face 166 of the flange 134, and the spring 152 thus engages the flange 134 the same way that the springs 106 fit around the flange portions 98 of the internal frames 90 and 92, as described above.

[0052] The spring 152 shown in FIG. 9 in the handle 38 is held slightly flexed, and thus the outer end portion 154 is elastically biased against a surface of the base portion 168 of the knife blade 60, while the outer end portion 156 is elastically biased against a spacer member 170 which has a radial depth 174 similar to that of the base portion 168 and is located on the pivot axle 77, so that in reaction, the back side 164 of the central portion 158 is biased toward the inner face 166 of the flange 134. This pressure of the back side 164 against the inner face 166 keeps the spring 152 firmly engaged with the flange 134, so that it is unnecessary to have the spring attached to the frame side member 130 or captured by a fastener such as a rivet or other pin as in conventional jack knives.

[0053] In a similar fashion, another spring 152 is engaged with the flange 136 of the frame side member 132, also shown in FIG. 9. The opposite end portions 154 and 156 of the spring 152 shown associated with the flange 136 engage the base portion of the scissors 68 and another spacer 170. The springs 152 have a width 171, as may be seen in FIGS. 3 and 5, which approximates the thickness of the base portion 168, of the blade 60, and the base portion 172 of the scissors 68. The spacer members 170 each also have a thickness no less than and preferably slightly greater than the width of each spring 152, assuring that there is side clearance enough to allow movement of the end portions 154 and 156 of the springs 152.

[0054] The frame side member 130, with its flange 134, and the associated spring 152, the pivot axles 77 and 88, and a tool member such as the knife blade 60, with its base portion 168 located on the pivot shaft 88, and the spacer 170 located on the pivot shaft 77 taken together are a basic subassembly that could stand alone with the mere addition of a retaining element such as a head on each of the pivot shafts 88 and 77 wide enough to overlap a side of the end portion 154 or 156 of the spring 152, and a head or fastener on the other side of the frame side member 130 to prevent the pivot shafts 77 and 88 from moving axially out of engagement in the respective ends 144 and 146. As an alternative, the outer margin of the flange 134 could include a narrow lip 179 as shown in FIG. 9A.

[0055] The frame side member 132, including its flange 136, the associated spring 152, spacer 170, the scissors 68, and the pivot shafts 84 and 86 similarly are a basic subassembly of the handle 40. It will be understood, then, that several of such frame side members 130, each having its own flange 134, could be mounted on a pair of pivot shafts 77 and 88 without an internal frame member 90 or 92, with the flanges 134 similarly located and oriented, similarly located but facing toward each other to form a split channel, as shown in FIG. 9B, or oppositely located and facing toward the opposite frame side member as a box-like frame having a tool bit or blade available on each side, as shown in simplified fashion in FIG. 9C.

[0056] A frame side member 180, seen in FIG. 2 where the scale 72 has been cut away, has a flange 182 seen in FIGS. 10 and 10A. Alongside the frame side member 180, which is not shown in FIG. 10, except for its flange 182, is an elongate special spring 184 which has a pair of similar opposite end portions 186 each defining an opening 188 within which a respective one of the pivot axles 77 and 88 has a small amount of clearance. The end portions 186 extend toward a central portion 190, which is offset away from the flange 182 toward the base portion or tang 192 of the corkscrew 54. The tang 192 is attached to the frame side member 180 by a pivot pin 194 in the pivot joint 76. A flat engagement surface 196 on a side of the tang 192 lies alongside a central portion 190 of the spring 184, while another flat engagement surface 198 is also present on a bottom or inner end of the tang 192.

[0057] An elongate spring 152 is located behind the special spring 184 and has one of its opposite ends 156 biased against a surface of the base portion of the combined can opener and bottle opener 56, its central portion 158 biased against the inner face 202 of the flange 182, and the other one 154 of its opposite end portions biased against a spacer 170 located on the pivot axle 88.

[0058] In the portion of the handle 40 shown in FIGS. 10 and 11, the drop point knife blade 66 is shown latched in its deployed position with an end portion 154 of the respective spring 152 engaged in a locking notch 204 of the base portion 206 of the knife blade 66, as will be explained in greater detail subsequently.

[0059] Referring now particularly to FIG. 10A, the combination can opener and cap lifter 56 has been removed from its stowed position in the handle 38 by pivoting about the pivot axle 77 to provide clearance for the corkscrew 54 to be raised from its stowed position shown in FIG. 10. As the corkscrew 54 is raised a corner 208 of its tang 192, defined by the intersection of the engagement surfaces 196 and 198, rides on the adjacent surface of the central portion 190 of the spring 184, deflecting the spring elastically toward the flange 182. The opposite end portions 186 simultaneously rotate through a small angle about the pivot axles 88 and 77, and the spring 184 urges the corkscrew 54 toward a stable position either stowed, as shown in FIG. 10, or extending perpendicular to the handle 38 with the engagement surface 198 resting on the central portion 190 of the spring 184, which facilitates turning the corkscrew 54 into a cork to be removed from a bottle.

[0060] FIG. 11 shows in greater detail the engagement of one of the outer end portions 154 of one of the elongate beam springs 152 with the base portion 206 of the knife blade 66 in its deployed position as shown in FIG. 10. A peripheral surface of the base portion 206

includes a detent cam portion 210 defining one side of the blade locking notch 204, and a shallow notch in the outer end portion 154 of the spring 152 defines a detent catch 212 that engages the notch 204 when a tool member such as the knife blade 66 is in the deployed position. Engagement of the detent catch 212 in the locking notch 204 increases the force required to move the deployed tool member away from the deployed position, as compared with a merely flat surface on the outer portion 154 of the spring and a corresponding parallel flat surface in place of the detent cam surface shown at 210.

[0061] An abutment surface 214 of the base portion 206 rests against an end surface 216 of the elongate spring 152, that counteracts forces tending to move a tool member about the respective axle in the direction indicated by the arrow 218. When such a force is directed by the abutment face 214 into the spring 152 through its end face 216, the force is carried through the end portion 154 of the spring 152 to the abutment shoulder 160 and thence to the end face 222 of the flange 220 of the frame side member 142. Because the distance between the abutment shoulders 160 of the central portion 158 is only a very small distance greater than the length 224 of the flange 220, when the outer end portion 154 of the spring 152 associated with the flange 220 is flexed by engagement of the outer end portion 154 with the base portion 206 of the knife blade 66 or another tool member, the abutment shoulders 160 closely approach or contact the end faces 222 and the spring 152 is prevented from moving appreciably with respect to the flange 220, so that the tool member, such as the knife blade 66, is held steadily in its deployed position as shown in FIGS. 10 and 11. Similarly, the springs 106 retain the pliers jaws 32 and 34 in their deployed positions as end faces of the springs 106 bear against abutment faces 226 on the base portions 42 and 44 of the jaws 32 and 34, shown in FIGS. 5 and 8.

[0062] Corresponding arrangements of cam surfaces, blade locking notches, and detent dogs are preferably provided on all of the springs 106 and 152 and may be provided on the base portions of all of the tool members or blades. The base portion of each of the tool members or blades preferably includes a cam profile followed by an end portion of the respective spring 106 or 152, which easily permits movement of each tool member between a position near its stowed position within one of the handles 38 or 40 and a position approaching its deployed position. For any of the tool members or blades other than the short screwdriver blades 46, 48, 50, and 52, the base portion preferably also includes a slightly protruding cam lobe 228 located so that pressure on the cam lobe 228 from the elastically biased outer end portion 154 of a spring 152 or outer end portion 108 or 110 of a spring 106 urges the respective tool member or blade into its respective stowed position within one of the handles 38 or 40. Such camming action and latching action of the springs on the blades and tool members strengthen a perception of precision in the tool 30.

[0063] As shown in FIG. 12, the pivot axles 77 and 88 fit snugly through precisely aligned holes provided in the scale 72, the frame side member 180, the spring 184, the frame side members 94 and 96 of the internal frame 90, and the frame side members 138 and 130, and finally through a scale 78. The base portions of selected blades and tool members, as previously shown, also include through holes, through which the pivot axles 77 and 88 fit snugly and rotatably, and for each place adjacent one of the frame side members 130, 132, 142, etc., where there is no tool member or blade, there is a corresponding spacer 170, none of which are shown in FIG. 12. The interconnection of the various frame side members and internal frame side members, with tool members and blades in place, may be seen in detail in FIG. 13.

[0064] The frame side members and internal frames of the handles 38 and 40 are shown together with the pivot axles 77 and 84 and the handle scales 72 and 78 in FIG. 14, as seen from the same direction as in FIGS. 3 and 13.

[0065] In FIG. 15 are shown the handles 230 and 232 for a folding multipurpose tool 234 basically similar to the tool 30, but in which fewer outer frame side members are included. Room is thus available for fewer tool members and blades, although a frame side member 180 affording room for the corkscrew 54 is included.

[0066] In a multipurpose folding tool 236 which is another different embodiment of the invention, whose handles are shown similarly in FIG. 16, without springs or tool members or blades, room is provided by external frame side members with flanges and associated springs for a similar number of tool members and blades, with the exception that there is a frame side member 239 of the same type as the frame side member 130 instead of a frame side member 180 that would allow installation of a corkscrew 54 among the tool members in the upper handle 238.

[0067] Shown in FIG. 17 are the handles for a folding multipurpose tool 240 that is an even simpler embodiment of the invention, depicted in the same skeleton fashion. Such a tool 240 includes a space in an upper handle 242 to receive a corkscrew 54 in an external handle subassembly including a frame side member 180, while a pair of mirror opposite scales 244 and 246 are utilized on the frame side members 94 of the internal frames 90 and 92 of its handles 242 and 248.

[0068] A pair of handles for a similar but slightly different folding tool 250, shown in FIG. 18, also has a frame side member 239 similar to the frame side member 130 instead of a frame side member 180 in its upper handle 252, which is otherwise similar to the handle 242. The lower handle 248 is similar to that shown in FIG. 17.

[0069] In assembling a multipurpose tool according to the present invention, a pair of pivot axle members 84 and 86 such as suitable rivets are first inserted into the corresponding holes at the opposite outer ends of the

appropriate scale 78 and the frame side member 142, with its flange 220. With the frame side member 142 and scale 78 firmly seated on the pivot axles 84 and 86, the frame side member 142 and the scale 78 are held clamped in a suitable fixture (not shown). A spring 152 is clamped in place on the frame side member 142, with its central portion 158 seated snugly against the flange 220. Next, the outer end portions 154 and 156 are both pushed away from the pivot axles 84 and 86 far enough to provide clearance for installation of the base portion 206 of a tool member such as the knife blade 66 and the spacer member 170, respectively, onto the pivot axles 86 and 84. Then, once the end portions 154 and 156 are released to press elastically upon the base portion 206 and spacer member 170, as well as the inner face 166 of the flange 220, the subassembly 254 thus completed will remain assembled as a unit.

[0070] Similarly, the subassembly 256 shown in FIG. 20 in an exploded view is assembled by first fastening the rivet or other pivot pin 194 to connect the tang 192 of the corkscrew 54 to the frame side member 180 and then inserting the rivets which will become the pivot axles 77 and 88 through the scale 72 and the frame side member 180. Preferably, the scale 72 includes a hole that fits closely about the exposed end of the pivot pin 194. Next, the spring 184 is placed onto the pivot axles 88 and 77, and flexed somewhat, and then placed adjacent the frame member and alongside the engagement surface 196 of the corkscrew tang 192. A spring 152 is then placed atop the spring 184 with its central portion 158 resting on the flange 182 and clear of the tang 192. These members are clamped together in a fixture (not shown), and force is applied to the end portions 154 and 156 of the spring 152 to provide clearance for installation of the appropriate spacers 170 and the combined can opener and corkscrew brace 56, respectively, onto the pivot axles 88 and 77. A small tool bit or blade such as a finger nail tool 258 (not shown in FIG. 1) may be fitted on the pivot axle 88 with spacers 170 of the appropriate thicknesses.

[0071] Referring next to FIG. 21, after assembly of the subassemblies 254 and 256 shown in FIGS. 19 and 20, the pair of springs 106 is placed into each of the interior frames 90 and 92 engaging the flange 98. A suitable fixture is preferably utilized to clamp the springs 106 onto the internal frames 90 and 92 with enough pressure applied to the end portions 108 and 110 of the springs 106 to provide clearance for installation of tool members such as the screwdriver blades 48, 50, and 52 into the internal frame member 90, and the screwdriver 46 and lanyard link 47 into position in the internal frame 92, as well as to place the base portions 42 and 44 of the pliers jaws 34 and 32 into place between the frame side members 94 and 96 of each internal frame 90 and 92. The pivot axles 77, 84, 86, and 88 of the subassemblies 240 and 242 are then inserted through the appropriate holes defined in each of the frame side members 94 and 96 of each internal frame 90 and 92. Once the frame side member subassemblies 254 and 256 have been placed alongside the internal frame members 90 and 92, with the pivot axles 77, 84, 86, and 88 in place, the fixtures can be released, and the springs 106 will then be elastically biased to press against the base portions of the screwdriver blades 46, 48, 50 and 52 and pliers jaws 32 and 34.

[0072] Thereafter, as shown in FIG. 22, the subassembly resulting from the operations described in connection with FIG. 21 is turned over to expose the outer ends of the pivot axles 77, 84, 86 and 88, and the next desired blades and spacers 170 are placed over the upwardly directed ends of the pivot axles. Respective springs 152 are placed into position stop the frame side members 94 alongside the blades and spacers and clamped into place. The frame side members 138, 140 are placed with their respective flanges 134 pressed against the central portions 158 of the springs 152, and the external frame side members 138 and 140 are placed onto the pivot axles 77, 84, 86, and 88 and pushed down snugly against the internal frame members 90 and 92. Additional tool members or blades, springs, and external frame side members (not shown) may also be added, provided long enough pivot axles are used.

[0073] As a final step, the scales 244 and 246 are placed onto the pivot axles 77, 84, 86 and 88, which are then riveted or otherwise fastened to hold the several frame side members, tool members, blades, and scales together with the precisely required amount of axial clearance along the pivot axles to permit the blades and other tool members to be moved without undue force being required. Rivets may be formed in accordance with U.S. Patent Application Serial No. 09/631,876, now U.S. Patent No. _____, and U.S. Patent No. 5,855,054.

[0074] The scales 244 and 246 shown in FIG. 23 have nail nick access indentations 258 and 260 near their ends, in contrast with the centrally located indentations 80 on the scales 78 of the handles shown in FIG. 4, since the scales 244 and 246 fit alongside the interior frame side members 94 and 96. The several shapes of the scales 72, 78, 244 and 246 all provide a pleasing profile for each handle 38, 40, etc. Each may be made of materials selected for appearance and is shaped to fit around the edges of the frame side member and provide comfortably rounded margins for the handles, so that the tool can be carried comfortably in one's pocket.

[0075] Regarding operation of the corkscrew 54 and its associated brace portion 56, as shown in FIGS. 24 and 25, the folding multipurpose tool 30 of the present invention is used to remove a cork 268 from a bottle neck 270 in a manner generally similar to that used with the well-known "waiter type" corkscrews. A flange 272 stiffens the corkscrew brace 56. Additionally, a wider portion 75 of the flange 252 extends laterally outward near the corkscrew 54 to facilitate engaging the brace 56 with one's thumb to extend the brace 56 and thus provide

clearance to move the corkscrew 54 to a perpendicularly extended position with respect to the handle 38. The corkscrew 54 is held in this extended position by the pressure of the central portion 190 of the spring 184 against the engagement surface 198 of the tang 192 of the corkscrew 54, as may be seen in FIG. 10A. With the brace 56 kept far enough away, the corkscrew 54 can be threaded conveniently into the cork 268. Since the brace 56 is located alongside the frame side member 180 of the handle 38, the foot 276 is easily placed atop the lip 278 of the bottle neck 270 after the corkscrew 54 has been threaded into the cork 268, by rocking the handle 38 about the pivot joint 76 that attaches the tang 192 to the frame side member 180. Although the foot 276 is slightly to one side of the longitudinal axis 274 of the corkscrew 54, the brace 56 adequately supports that end of the handle 38 so that the pivot axle 88 acts conveniently as a fulcrum about which the handle 38 is pivoted with respect to the brace 56. At the same time the tang 192 of the corkscrew 54 pivots simultaneously about the pivot joint 76 as the corkscrew 54 raises the cork 268 when the handle 38 is raised and pivoted about the pivot axle 88. Pressure of the central portion 190 of the special spring 184 against the corner 208 and the engagement surface 198 of the base 192 of the corkscrew 54 urges the corkscrew 54 toward its perpendicularly extended position as the handle 38 is raised to pull the cork 248 from the bottle neck 242.

[0076] The terms and expressions which have been employed in the foregoing specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

Claims

1. A sub-assembly for a folding tool, comprising:

   a first frame side member (180) having a pair of opposite ends, an integral flange member (182) extending laterally from said first frame side member (180);
   a pair of spaced-apart pivot axles (77, 78) extending through said first frame side member (180), each of said pivot axles (77, 78) being located near a respective one of said opposite ends of said first frame side member (180); and
   a tool member (54) having a base (192) attached to the first frame side member (180) by a pivot joint (76) separate from and located generally between said pivot axles (77, 78), said tool member (54) being movable about said pivot joint (76) between two positions, and said base (192) of said tool member (54) having an engagement surface (196, 198) corresponding to one of said two positions and,

   characterised by a spring (184) having a pair of opposite end portions (186) each defining an opening (188) through which extends a respective one of said pivot axles (77, 78), thereby supporting the end portions (186), and a central portion (190) aligned with and biased into contact with said base (192) of said tool member (54), said spring (184) urging said tool member (54) into said one of the two positions when said central portion (190) is in contact with said engagement surface (196, 198).

2. A sub-assembly according to Claim 1, wherein said central portion (190) of said spring (184) is spaced apart from said flange member (182) and has clearance to move towards said flange member (182) in response to movement of said base (192) about said pivot joint (76).

3. A sub-assembly according to Claim 1 or 2, wherein said base (192) of said tool member (54) has an additional engagement surface (196, 198), a respective one of said engagement surfaces (196, 198) corresponding to each of said two positions, and wherein said spring (184) urges said tool member (54) into a selected one of said two positions wherein said central portion (190) is in contact with said respective one of said engagement surfaces (196, 198) corresponding with said selected one of said two positions.

4. A sub-assembly according to any preceding claim, wherein said tool member (54) is a corkscrew.

5. A sub-assembly according to any preceding claim, wherein said central portion (190) of said spring (184) is offset with respect to adjacent parts of said end portions (186) of said spring (184) away from said flange member (182) and toward said base (192) of said tool member (54).

6. A sub-assembly according to Claim 5, wherein said central portion (190) of said spring (184) is aligned with said flange portion (182).

7. A sub-assembly according to Claim 5, wherein said flange portion (182) has an inner side and a pair of opposite end faces, said central portion (190) of said spring (184) is spaced apart from said inner side, and said end portions (186) of said spring (184) extend away from said opposite end faces of said flange portion.

8. A sub-assembly according to any preceding claim, further including a second frame side member (96).

9. A sub-assembly according to Claim 8, wherein said first and second frame side members (180, 96) define a channel therebetween.

10. A sub-assembly according to Claim 8 or 9, further including a second tool member (124, 68), between said first and second frame side members (180, 96).

11. A sub-assembly according to any preceding claim, including an elongate second spring (106, 152) separate from said frame side member (180) and having a pair of opposite free ends (108, 110, 154, 156), said second spring (106, 152) resting against said flange member (182) intermediate said ends (108, 110, 154, 156), and said sub-assembly also including: a third tool member (34, 60) having a base (42, 168); and a force-resisting member (48, 170), and wherein one of said free ends (110, 156) of said second spring (106, 152) rests against said force-resisting member (48, 170) said other of said free ends (108, 154) of said second spring (106, 152) rests against said base of said third tool member (34, 60) and said second spring (106, 152) is held between said first flange (182), said force-resisting member (48, 170) and said base (42, 168).

Patentansprüche

1. Unterbaugruppe fiir ein klappbares Werkzeug, umfassend:

   ein erstes Rahmenseitenteil (180), das ein Paar gegenüberliegenden Enden aufweist, wobei sich ein integrales Flanschteil (182) in Querrichtung von dem ersten Rahmenseitenteil (180) erstreckt;

   ein Paar von einen gegenseitigen Abstand aufweisenden Schwenkachsen (77, 88), die sich durch das erste Rahmenseitenteil (180) erstrecken, wobei sich jede der Schwenkachsen (77, 88) in der Nähe eines der einander gegenüberliegenden Enden des ersten Rahmenseitenteils (180) befindet; und

   ein Werkzeugteil (54), das einen Sockel (192) aufweist, der an dem ersten Rahmenseitenteil (180) durch eine Schwenkverbindung (76) befestigt ist, die von den Schwenkachsen (77, 88) getrennt ist und im allgemeinen zwischen den Schwenkachsen (77, 88) angeordnet ist, wobei das Werkzeugteil (54) zwischen zwei Positionen um die Schwenkverbindung (76) bewegbar ist, und wobei der Sockel (192) des Werkzeugteils (54) mit einer Eingreifoberfläche (196, 198) versehen ist, die einer der beiden genannten Positionen entspricht, und

   gekennzeichnet durch eine Feder (184), die ein Paar von einander gegenüberliegenden Endabschnitten (186) aufweist, von denen jeder eine Öffnung (188) festlegt, **durch** die sich eine entsprechende der genannten Schwenkachsen (77, 78) erstreckt, so daß **dadurch** die Endabschnitte (186) abgestützt werden, und einen mittleren Abschnitt (190), der ausgerichtet ist mit dem Sockel (192) des Werkzeugteils (54) und in Kontakt mit diesem vorgespannt ist, wobei die Feder (184) das Werkzeugteil (54) in die genannte eine der beiden Positionen drückt, wenn sich der zentrale Abschnitt (190) in Kontakt mit der Eingreifoberfläche (196, 198) befindet.

2. Unterbau gruppe nach Anspruch 1, **dadurch gekennzeichnet, daß** der zentrale Abschnitt (190) der genannten Feder (184) von dem Flanschteil (182) in einem Abstand angeordnet ist und einen Zwischenraum oder Spiel besitzt, um sich ansprechend auf eine Bewegung des Sockels (192) um die Schwenkverbindung (76) in Richtung auf das Flanschteil (182) zu bewegen.

3. Unterbaugruppe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Sockel (192) des Werkzeugteils (54) mit einer zusätzlichen Eingreifoberfläche (196, 198) versehen ist, wobei eine der genannten Eingreifoberflächen (196, 198) einer der genannten beiden Positionen entspricht, und wobei die Feder (184) das Werkzeug (54) in eine ausgewählte von den beiden genanten Positionen drückt, wobei sich der zentrale Abschnitt (190) in Kontakt mit derjenigen der genannten Eingreifoberflächen (196, 198) befindet, die der ausgewählten der beiden genannten Positionen entspricht.

4. Unterbaugruppe nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, daß** das Werkzeugteil (54) ein Korkenzieher ist.

5. Unterbaugruppe nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, daß** der zentrale Abschnitt (190) der genannten Feder (84) in Bezug auf benachbarte Teile der genannten Endabschnitte (186) der Feder (184) versetzt ist, weg von dem Flanschteil (182) und in Richtung auf den Sockel (192) des genannten Werkzeugteils (54).

6. Unterbaugruppe nach Anspruch 5, **dadurch gekennzeichnet, daß** der zentrale Abschnitt (190) der genannten Feder (184) mit dem Flanschabschnitt (182) ausgerichtet ist.

7. Unterbaugruppe nach Anspruch 5, **dadurch gekennzeichnet, daß** der Flanschabschnitt (182) eine innere Seite und ein Paar von einander gegen-

überliegenden Stirnseiten aufweist, wobei der zentrale Abschnitt (190) der Feder (184) in einem Abstand von der inneren Seite angeordnet ist, und wobei die genannten Endabschnitte (186) der Feder (184) sich weg von den einander gegenüberliegenden Stirnseiten des Flanschabschnitts erstrecken.

8. Unterbaugruppe nach einem der vorangehenden Ansprüche, weiter **gekennzeichnet durch** ein zweites Rahmenseitenteil (96).

9. Unterbaugruppe nach Anspruch 8, **dadurch gekennzeichnet, daß** die ersten und zweiten Rahmenseitenteile (180, 96) einen Kanal zwischen diesen bilden.

10. Unterbaugruppe nach Anspruch 8 oder 9, weiter **gekennzeichnet, durch** ein zweites Werkzeugteil (124, 68), zwischen den ersten und zweiten Rahmenseitenteilen (180, 96).

11. Unterbaugruppe nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** eine längliche zweite Feder (106, 152), getrennt von dem Rahmenseitenteil (180) und mit einem Paar von gegenüberliegenden freien Enden (108, 110, 154, 156), wobei die zweite Feder (106, 152) gegen das Flanschteil (182) anliegt, das sich zwischen den Enden (108, 110, 154, 156) befindet, und wobei die genannte Unterbaugruppe weiterhin umfaßt: ein drittes Werkzeugteil (34, 60) mit einem Sockel (42, 168); und ein einer Kraft widerstehendes Teil (48, 170), und wobei eines der freien Enden (110, 156) der genannten zweiten Feder (106, 152) gegen das genannte, einer Kraft widerstehende Teil (84, 170) anliegt, wobei das andere der beiden freien Enden (108, 154) der zweiten Feder (106, 152) gegen den Sockel des genannten dritten Werkzeugteils (34, 60) anliegt, und die genannte zweite Feder (106, 152) zwischen dem ersten Flansch (182), dem einer Kraft widerstehenden Teil (48, 170) und dem Sockel (42, 168) gehalten ist.

Revendications

1. Sous-ensemble d'un outil pliant comprenant :

   un premier élément latéral fixe (180) ayant une paire d'extrémités opposées, un élément de bride intégral (182) s'étendant latéralement à partir dudit premier élément latéral fixe (180);

   une paire d'axes de pivotement espacés (77, 88) traversant ledit premier élément latéral fixe (180), chacun desdits axes de pivotement (77, 88) étant situé près d'une extrémité respective desdites extrémités opposées dudit premier élément latéral fixe (180); et

   un élément d'outil (54) ayant une base (192) fixée au premier élément latéral fixe (180) par un raccord de pivotement (76) séparé et situé généralement entre lesdits axes de pivotement (77, 88), ledit élément d'outil (54) pouvant être déplacé autour dudit raccord de pivotement (76) entre deux positions, et ladite base (192) dudit élément d'outil (54) comportant une surface d'engagement (196, 198) correspondant à une desdites deux positions, et

   caractérisé en ce qu'un ressort (184) ayant une paire de parties d'extrémités opposées (186) définissant chacune une ouverture (188) traversée par un axe respectif desdits axes de pivotement (77, 88), supportant ainsi les parties d'extrémité (186), et une partie centrale (190) alignée avec et décalée par rapport à ladite base (192) dudit élément d'outil (54), ledit ressort (184) poussant ledit élément d'outil (54) dans l'une desdites deux positions lorsque ladite partie centrale (190) est en contact avec ladite surface d'engagement (196, 198).

2. Sous-ensemble selon la revendication 1, dans lequel ladite partie centrale (190) dudit ressort (184) est espacée dudit élément de bride (182) et comporte un dégagement pour pouvoir la déplacer vers ledit élément de bride (182) en réponse au déplacement de ladite base (192) autour du raccord de pivotement (76).

3. Sous-ensemble selon la revendication 1 ou 2, dans lequel ladite base (192) dudit élément d'outil (54) comporte une surface d'engagement supplémentaire (196, 198), une surface respective desdites surfaces d'engagement (196, 198) correspondant à chacune desdites deux positions, et dans lequel ledit ressort (184) pousse ledit élément d'outil (54) dans une position sélectionnée desdites deux positions dans lesquelles ladite partie centrale (190) est en contact avec une surface respective desdites surfaces d'engagement (196, 198) correspondant à une position sélectionnée desdites deux positions.

4. Sous-ensemble selon l'une quelconque des revendications précédentes, dans lequel ledit élément d'outil (54) est un tire-bouchon.

5. Sous-ensemble selon l'une quelconque des revendications précédentes, dans lequel ladite partie centrale (190) dudit ressort (184) est décalée par rapport aux parties adjacentes desdites parties d'extrémité (186) dudit ressort (184) loin dudit élément de bride (182) et vers ladite base (192) dudit élément d'outil (54).

6. Sous-ensemble selon la revendication 5, dans lequel ladite partie centrale (190) dudit ressort (184) est alignée avec ladite partie de bride (182).

7. Sous-ensemble selon la revendication 5, dans lequel ladite partie de bride (182) a un côté interne et une paire de surfaces d'extrémités opposées, ladite partie centrale (190) dudit ressort (184) est espacée dudit côté interne, et lesdites parties d'extrémités (186) dudit ressort (184) s'étendent loin desdites surfaces d'extrémités opposées de ladite partie de bride.

8. Sous-ensemble selon l'une quelconque des revendications précédentes, incluant en outre un second élément latéral fixe (96).

9. Sous-ensemble selon la revendication 8, dans lequel lesdits premier et second élément latéraux fixes (180, 96) définissent un canal entre eux.

10. Sous-ensemble selon la revendication 8 ou 9, incluant en outre un second élément d'outil (124, 68) entre lesdits premiers et seconds éléments latéraux fixes (180, 96).

11. Sous-ensemble selon l'une quelconque des revendications précédentes, incluant un second ressort allongé (106, 152) séparé dudit élément latéral fixe (180) et ayant une paire d'extrémités libres opposées (108, 110, 154, 156), ledit second ressort (106, 152) reposant contre ledit élément de bride (182) au niveau desdites extrémités (108, 110, 154, 156), et ledit sous-ensemble incluant également : un troisième élément d'outil (34, 60) ayant une base (42, 168) ; et un élément résistant à la force (48, 170), et dans lequel une desdites extrémités libres (110, 156) dudit second ressort (106, 152) repose contre ledit élément résistant à la force (48, 170), ladite autre extrémité desdites extrémités libres (108, 154) dudit second ressort (106, 152) repose contre ladite base dudit troisième élément d'outil (34, 60) et ledit second ressort (106, 152) est maintenu entre ladite première bride (182), ledit élément résistant à la force (48, 170) et ladite base (42, 168).

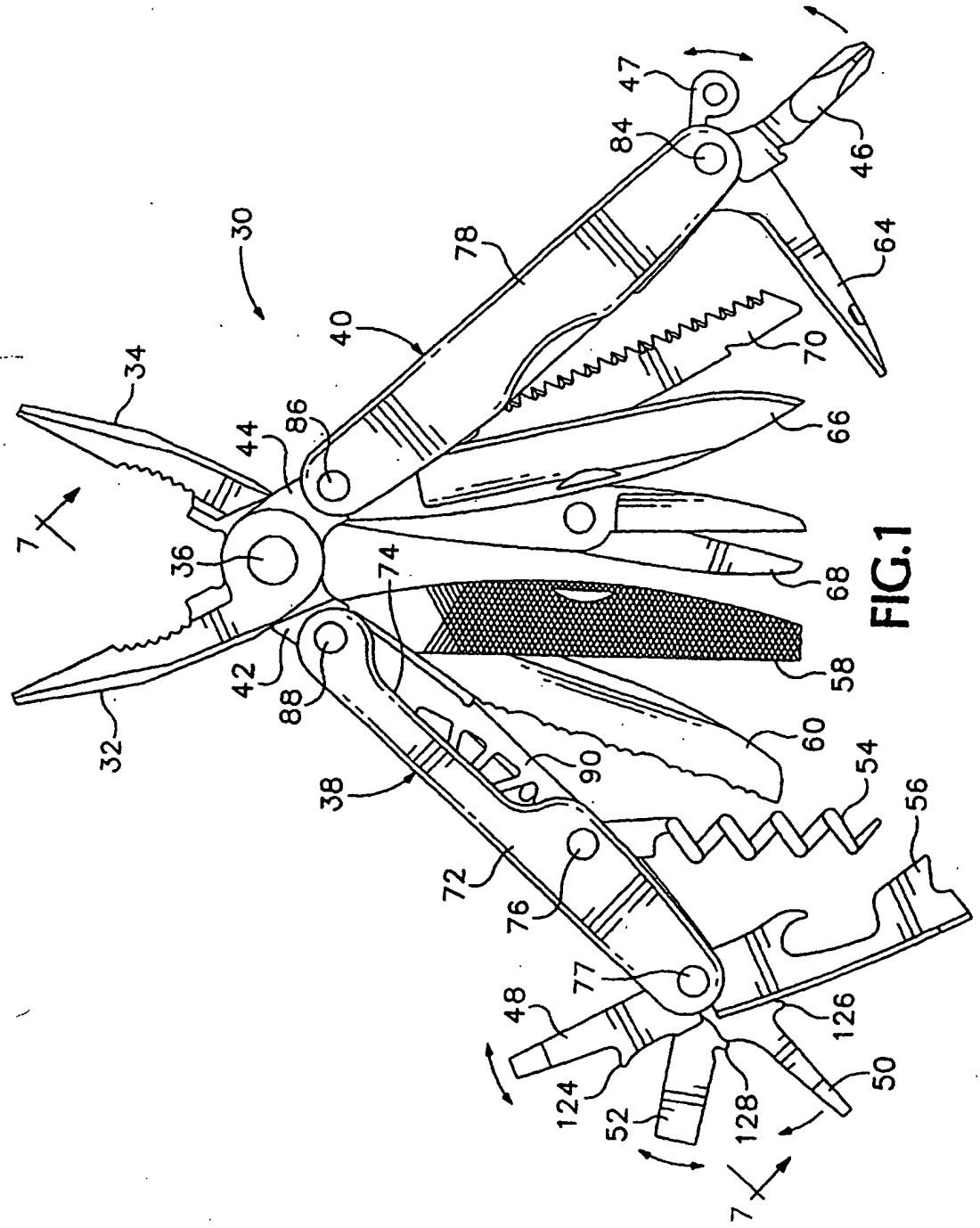
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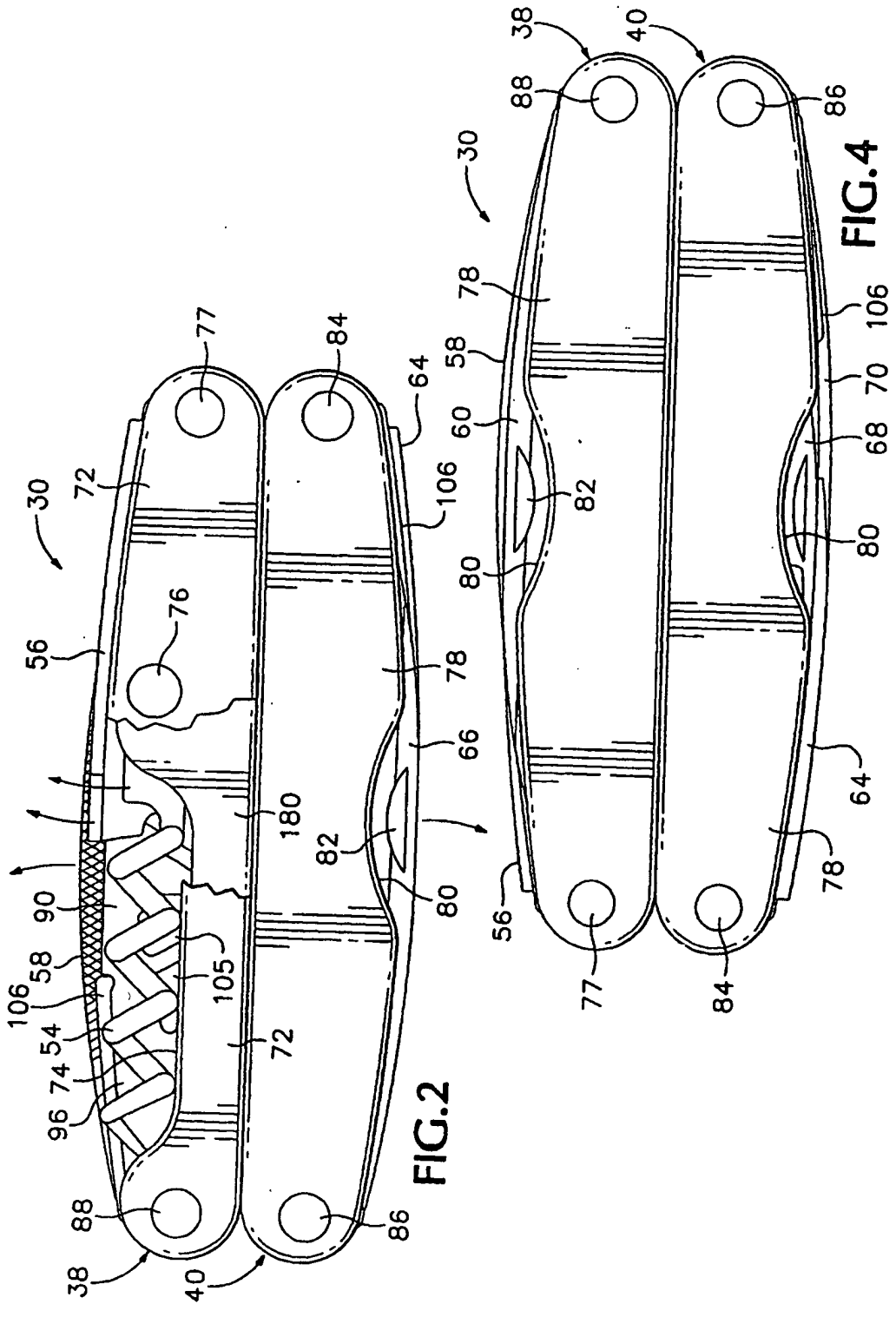
FIG.1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76
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64
106
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180
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105
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74
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FIG.2

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58
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82
80
106
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68
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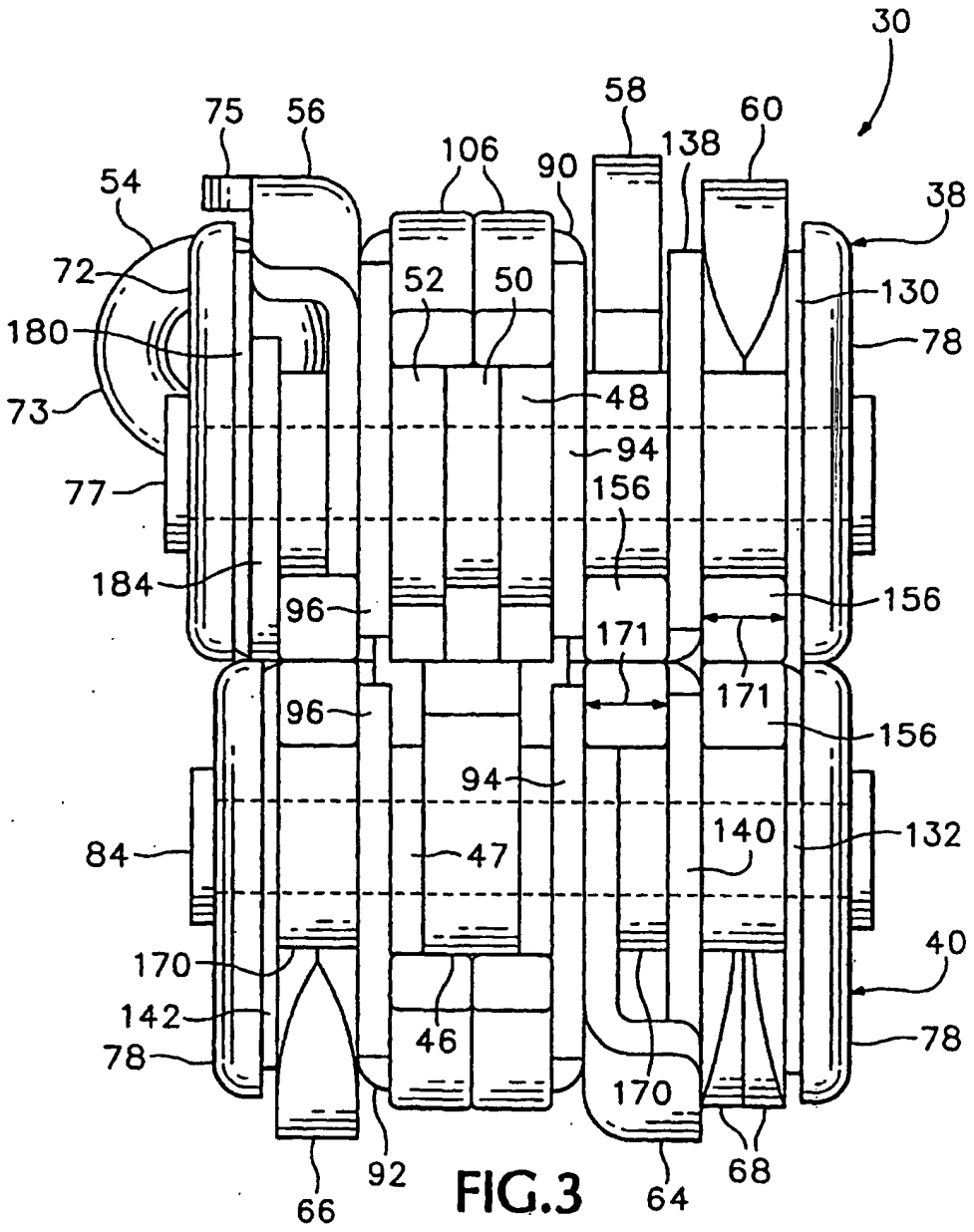
56
77
84

FIG.4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184
96
156
171
171
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78
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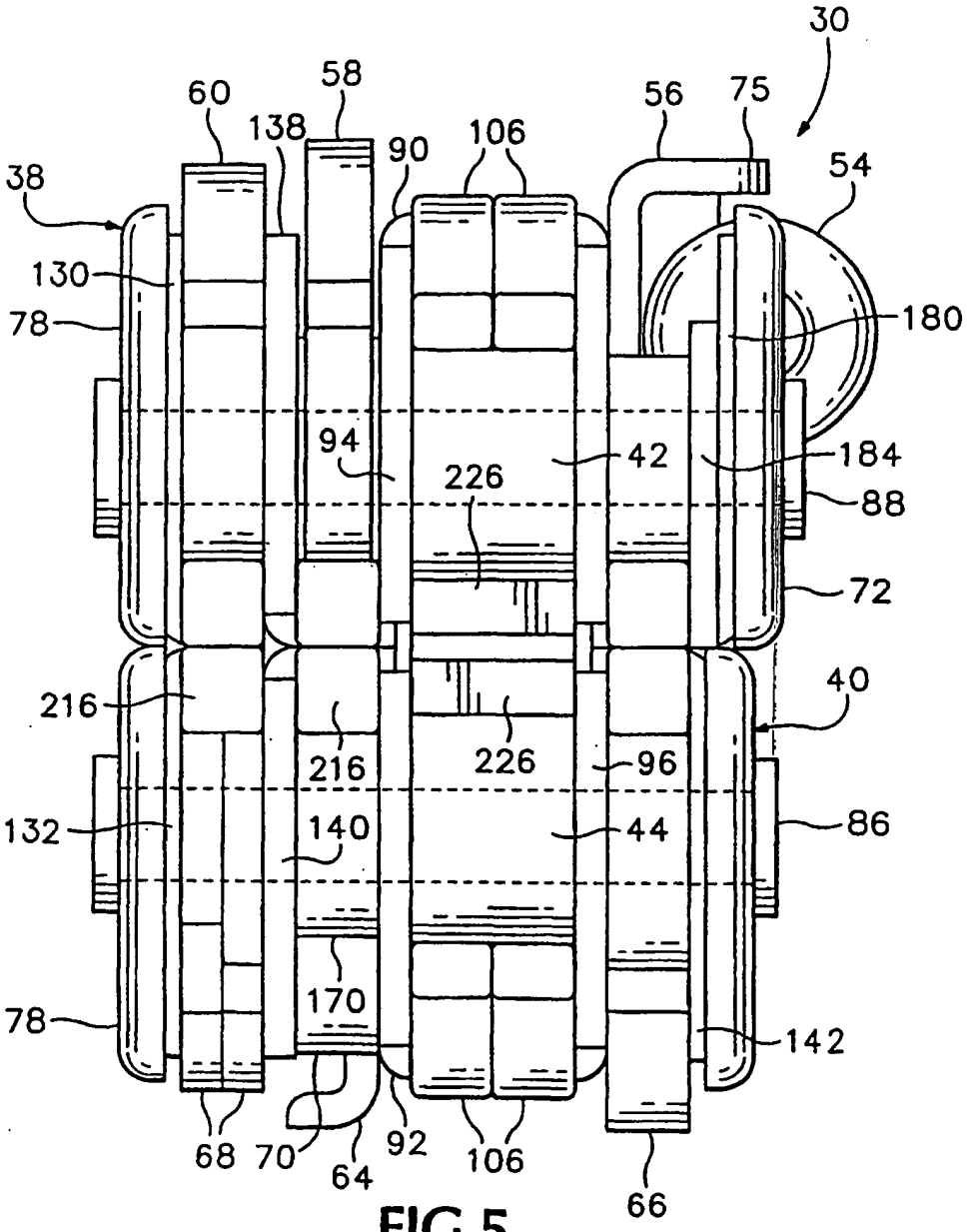
170
66
92
64
68

FIG.3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75
138
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106
54
38
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78
94
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226
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226
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132
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44
86
170
78
142
68
70
64
92
106
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FIG.5

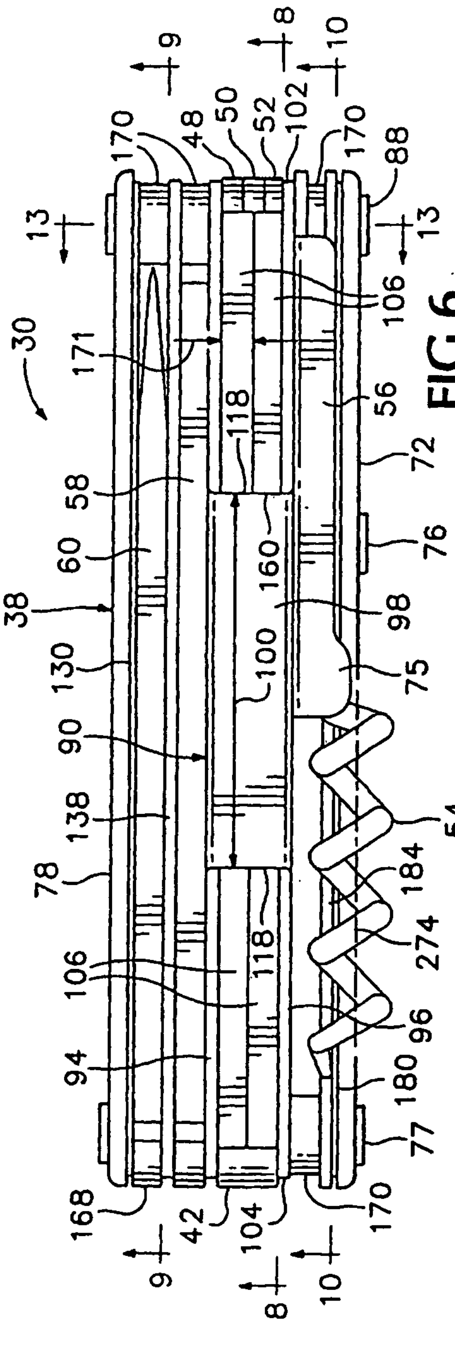


FIG.6

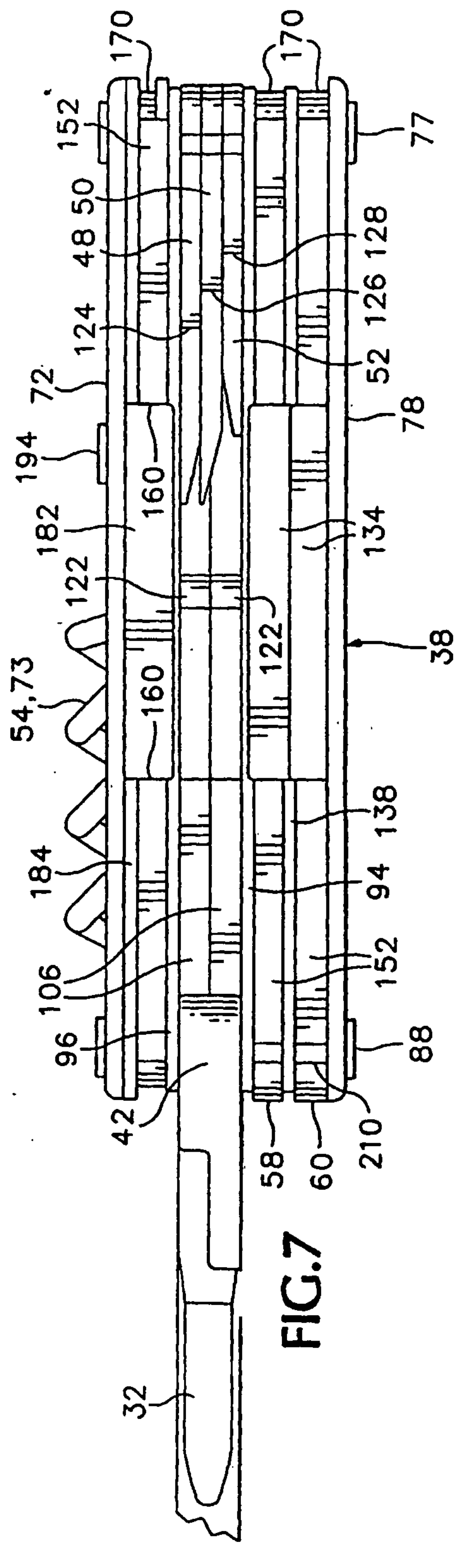
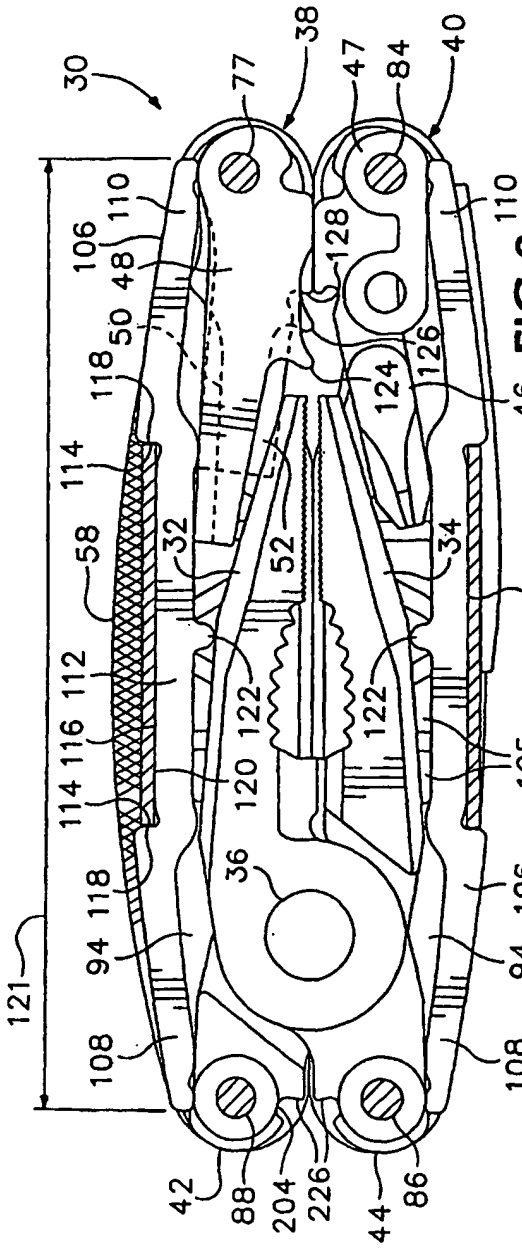


FIG.7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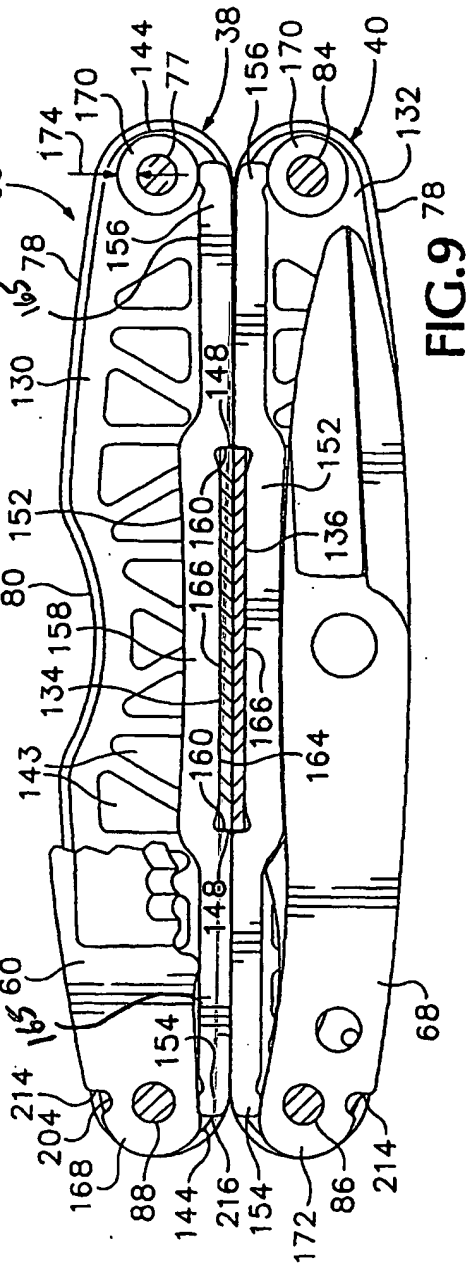
105

FIG.8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38
156
170
84
40
132
78
148
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152
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166
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134
143
164
136
60
154
214
204
168
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216
172
86

FIG.9

FIG.9C

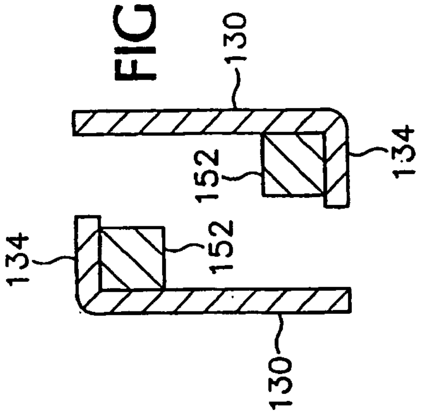


FIG.9B

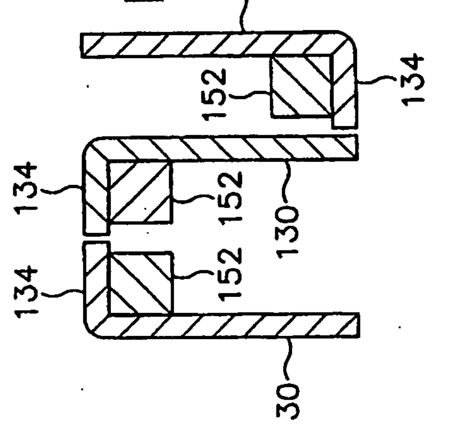


FIG.9A

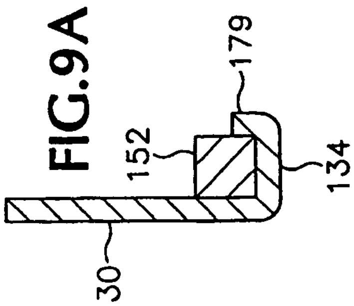
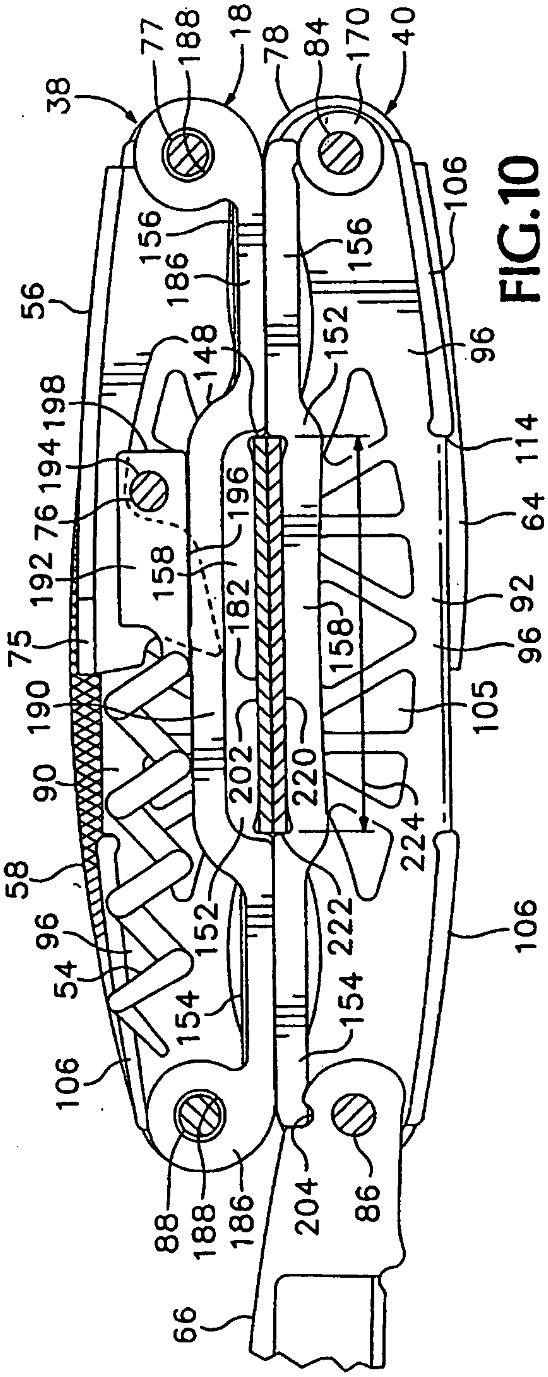


FIG.10



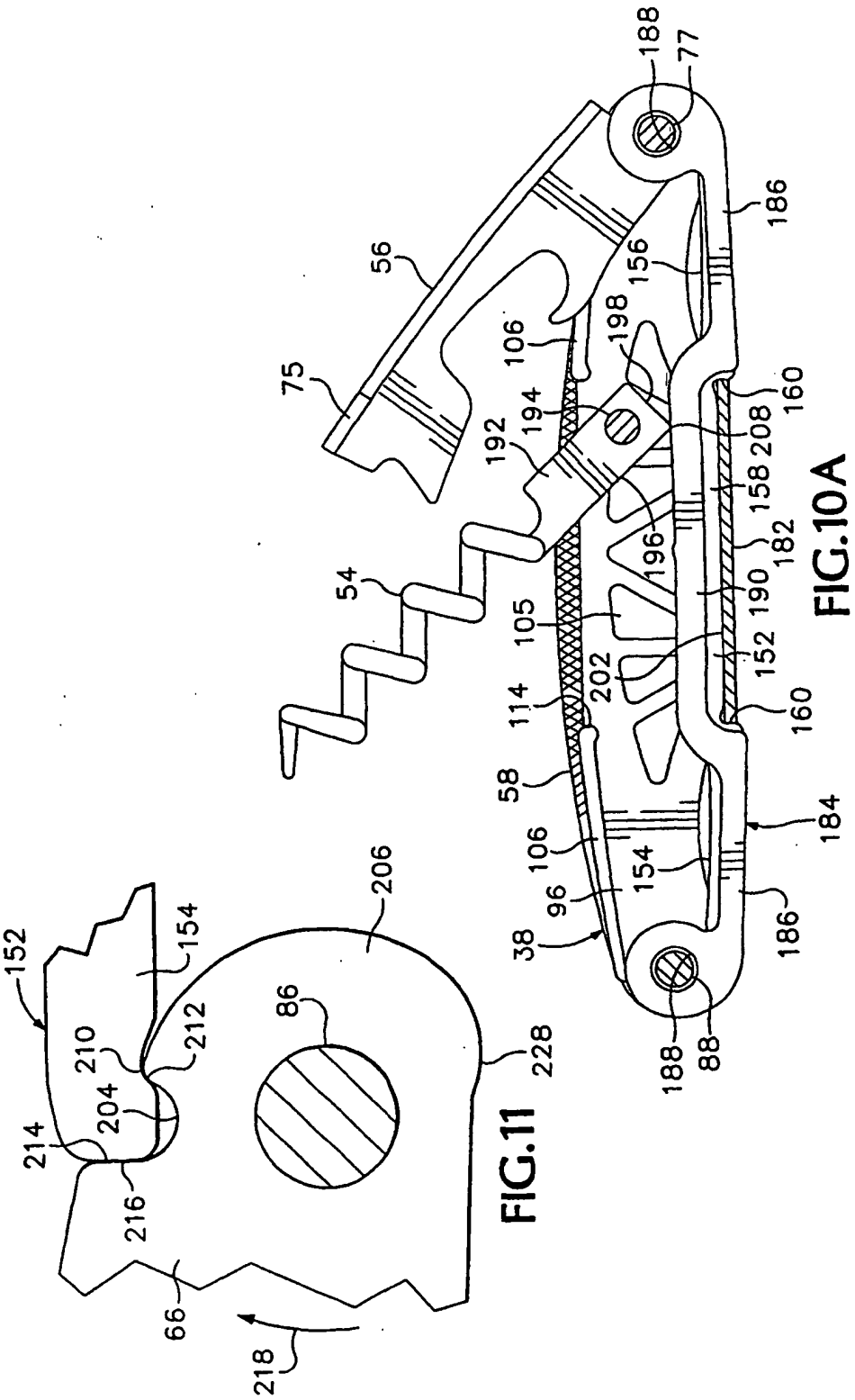
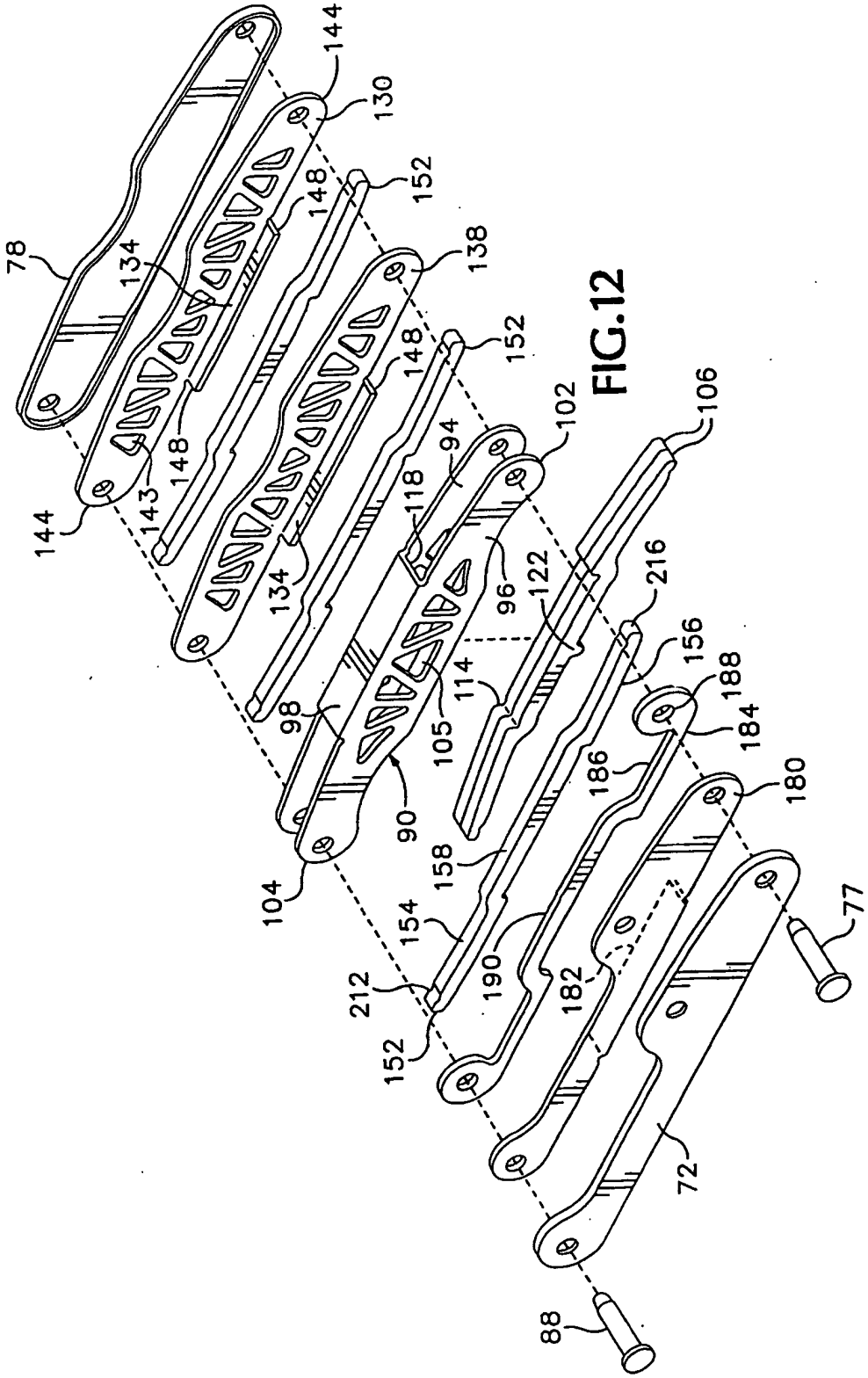


FIG.10A

FIG.11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212
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182
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72
88

FIG.12

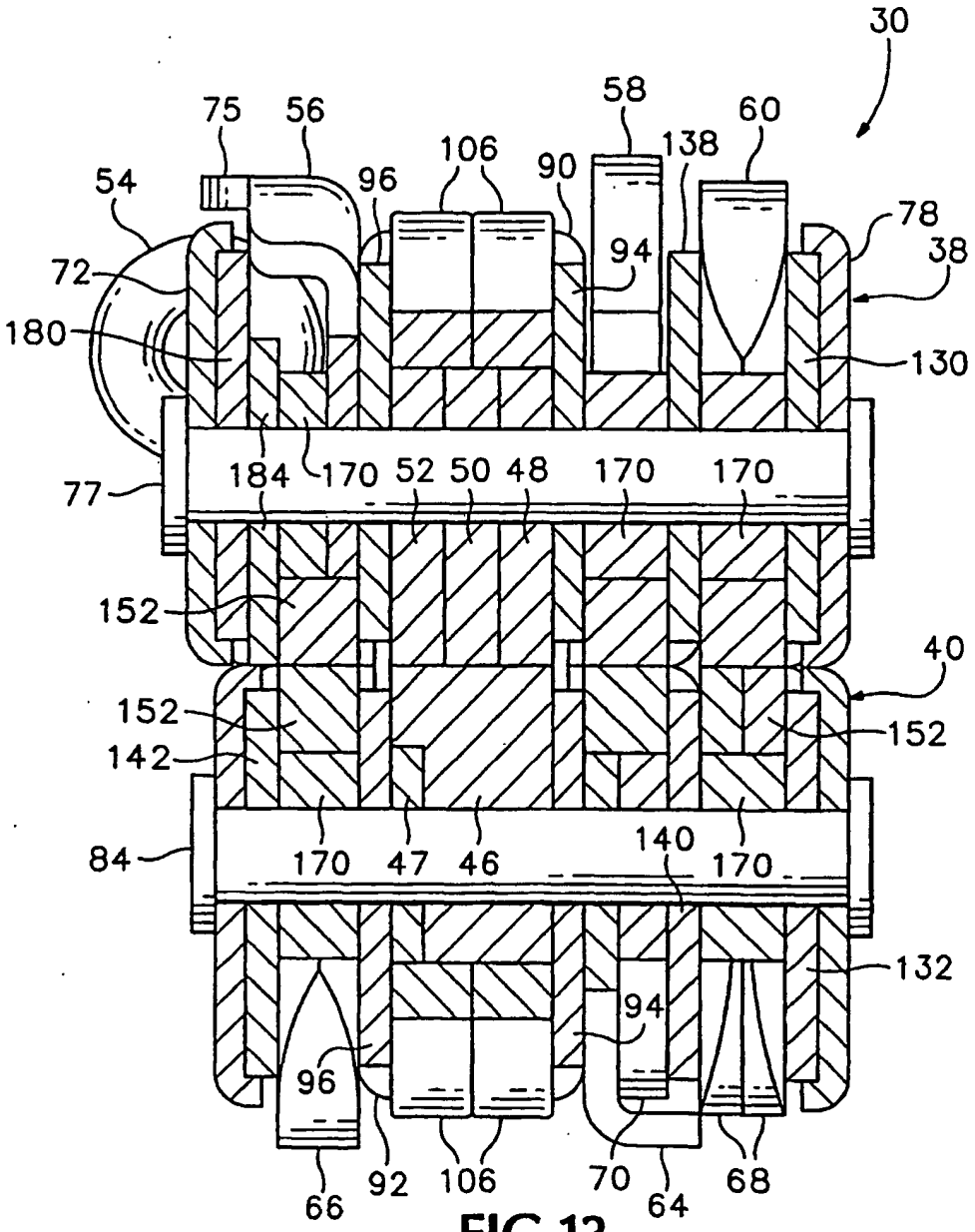
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FIG.13

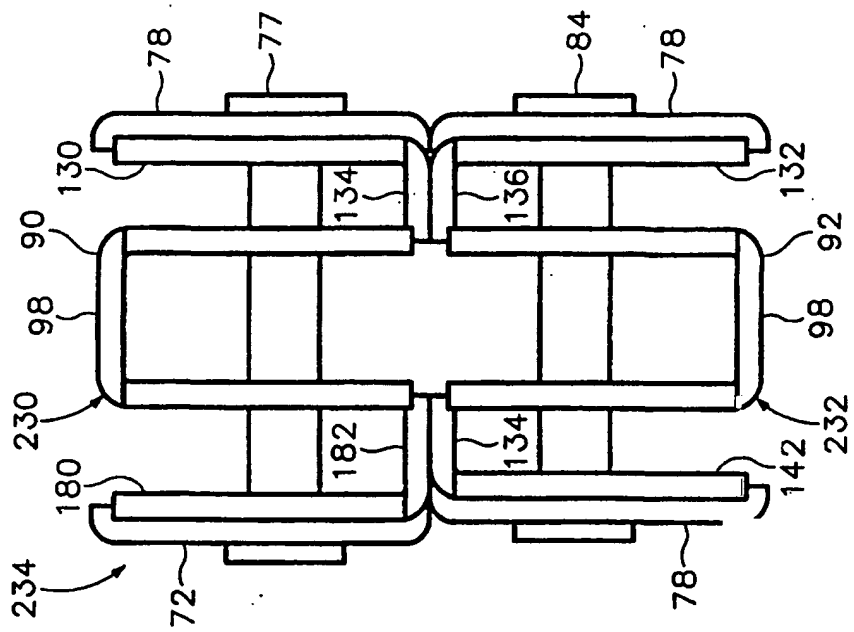
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FIG.15

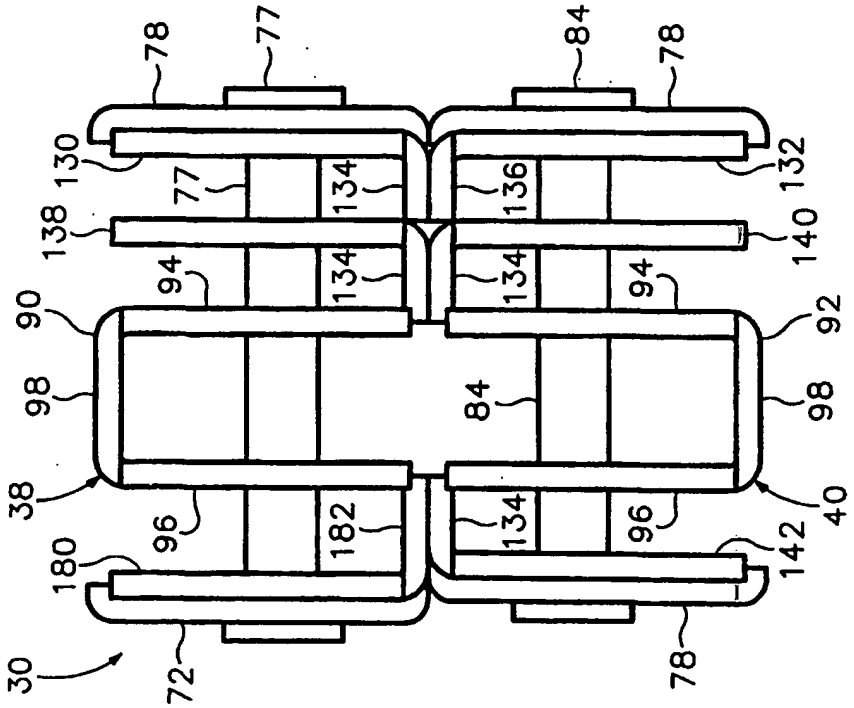
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FIG.14

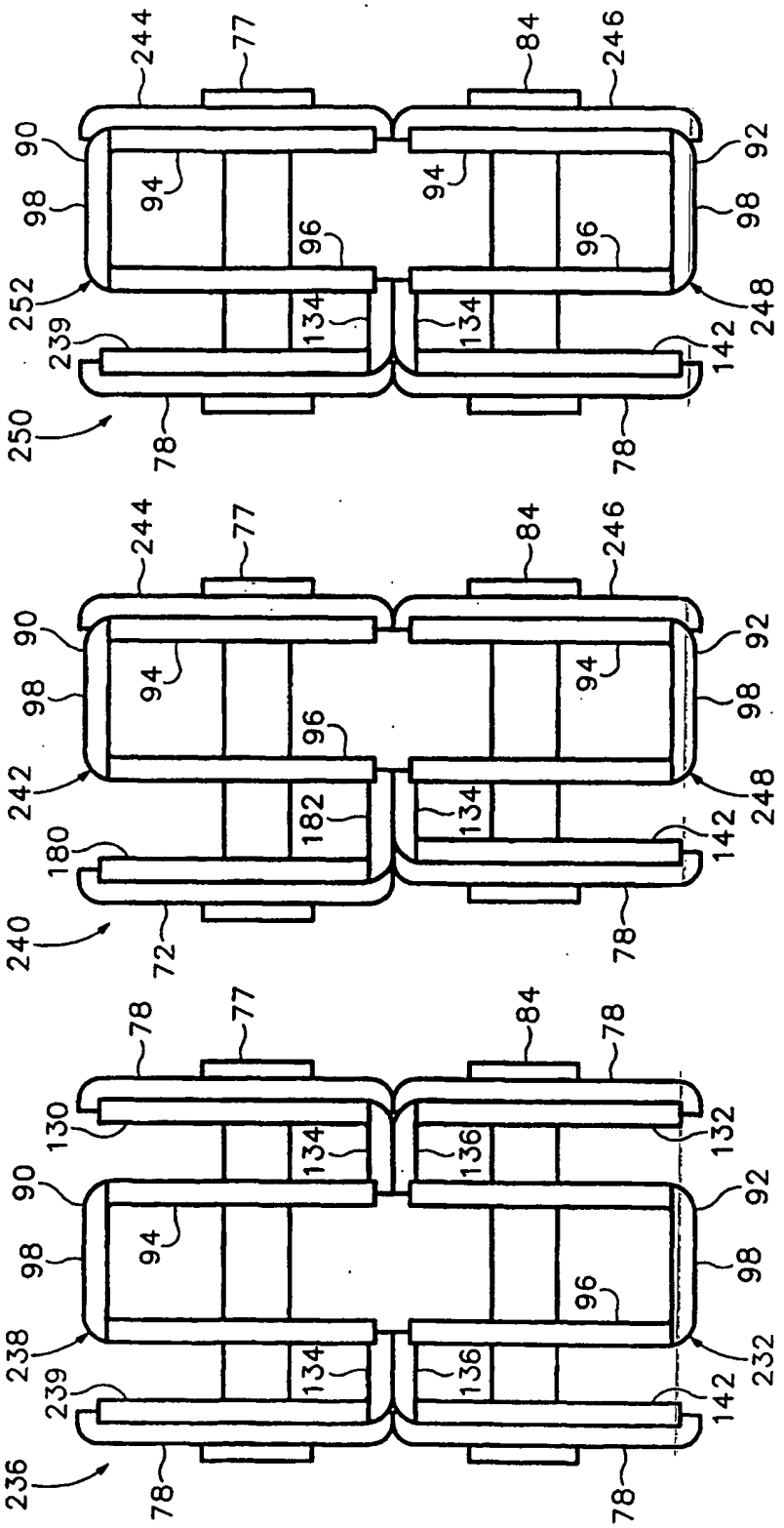

FIG.18

FIG.17

FIG.16

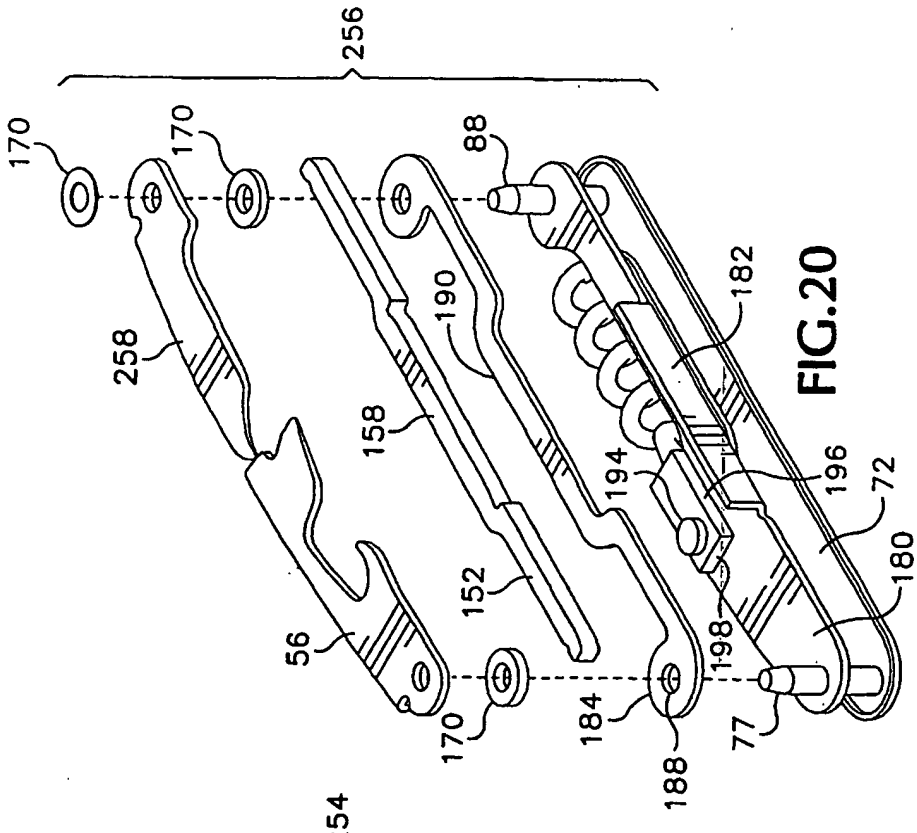
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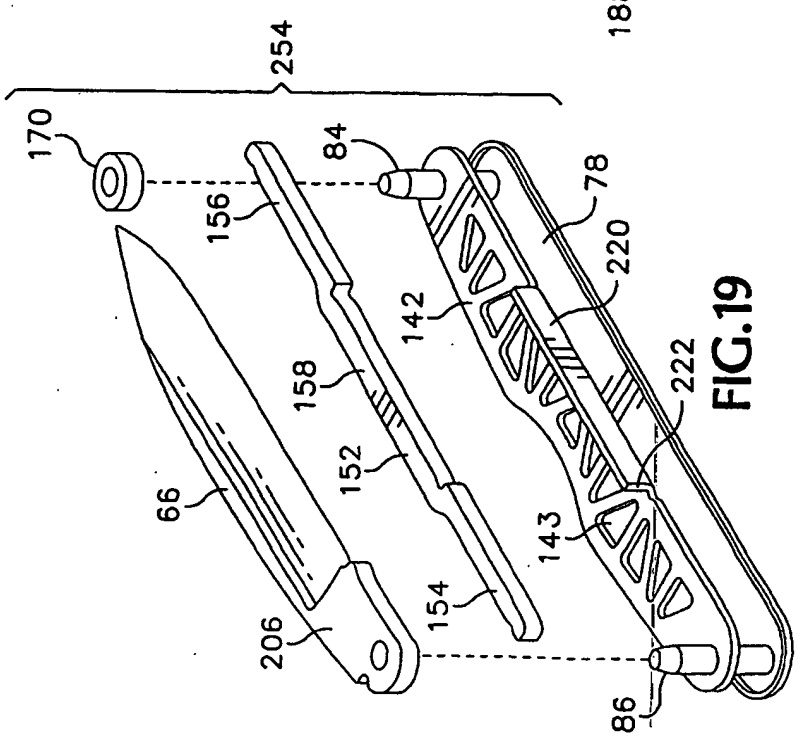
FIG.20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206
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FIG.19

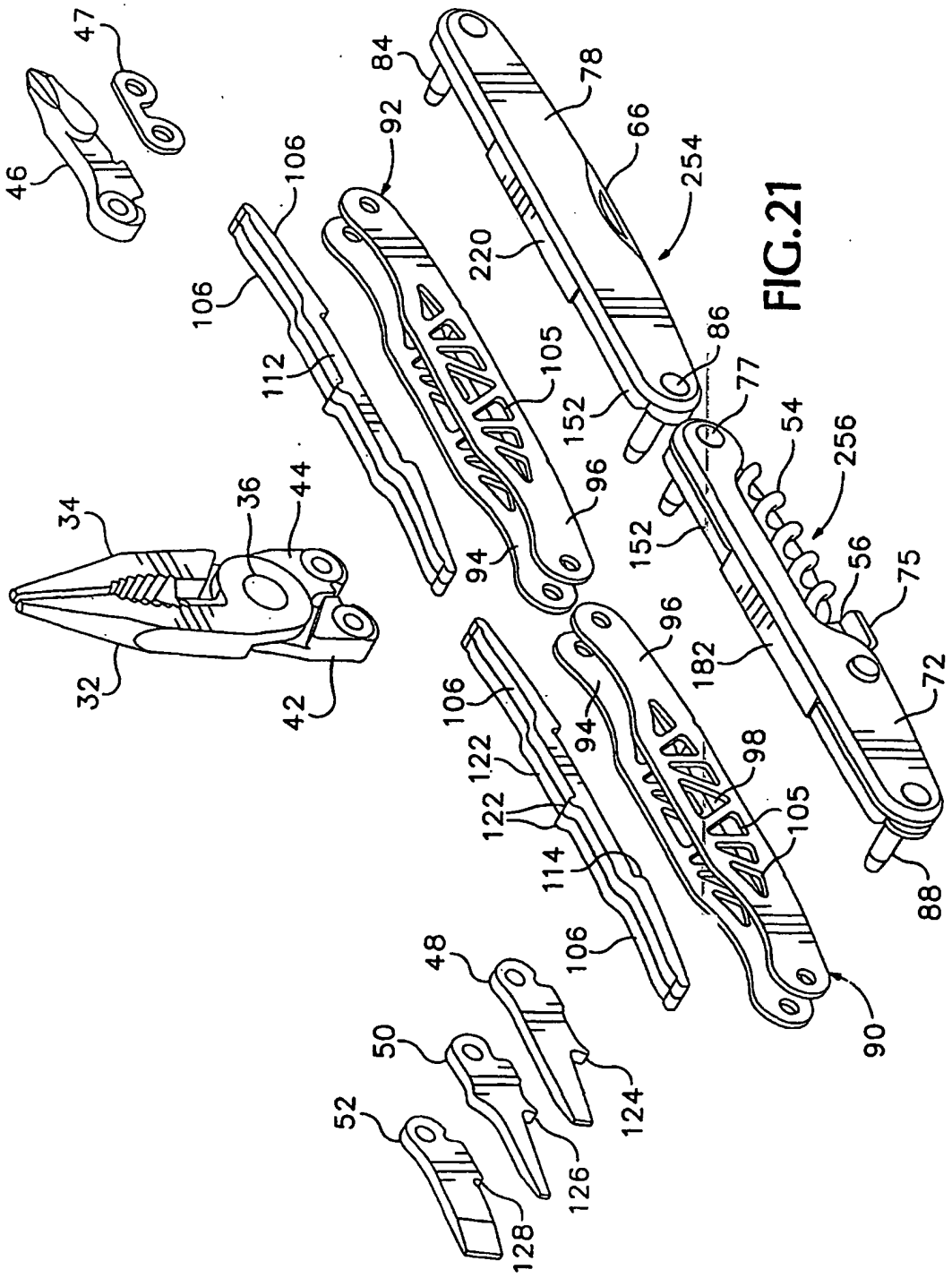
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FIG.21

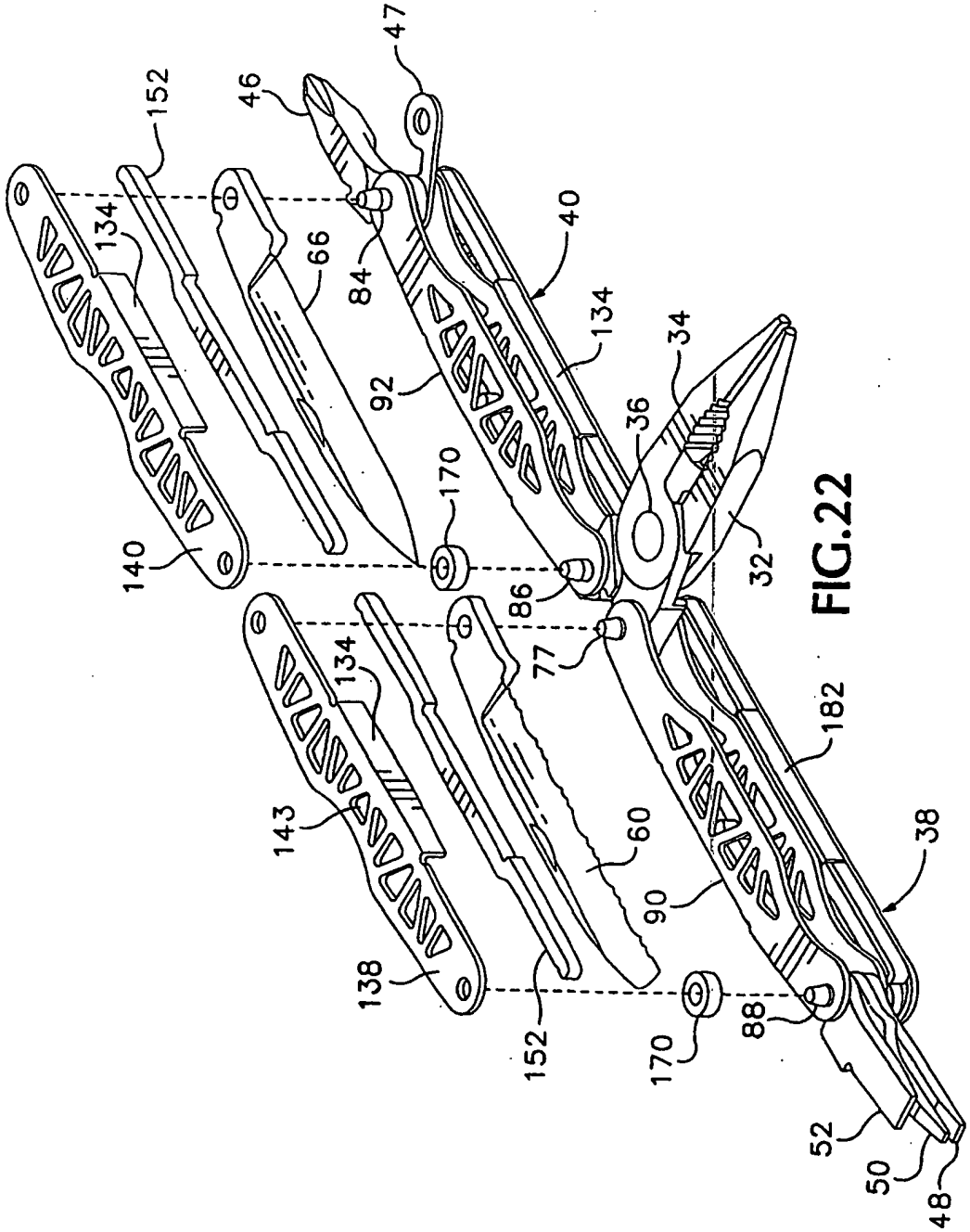
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FIG.22

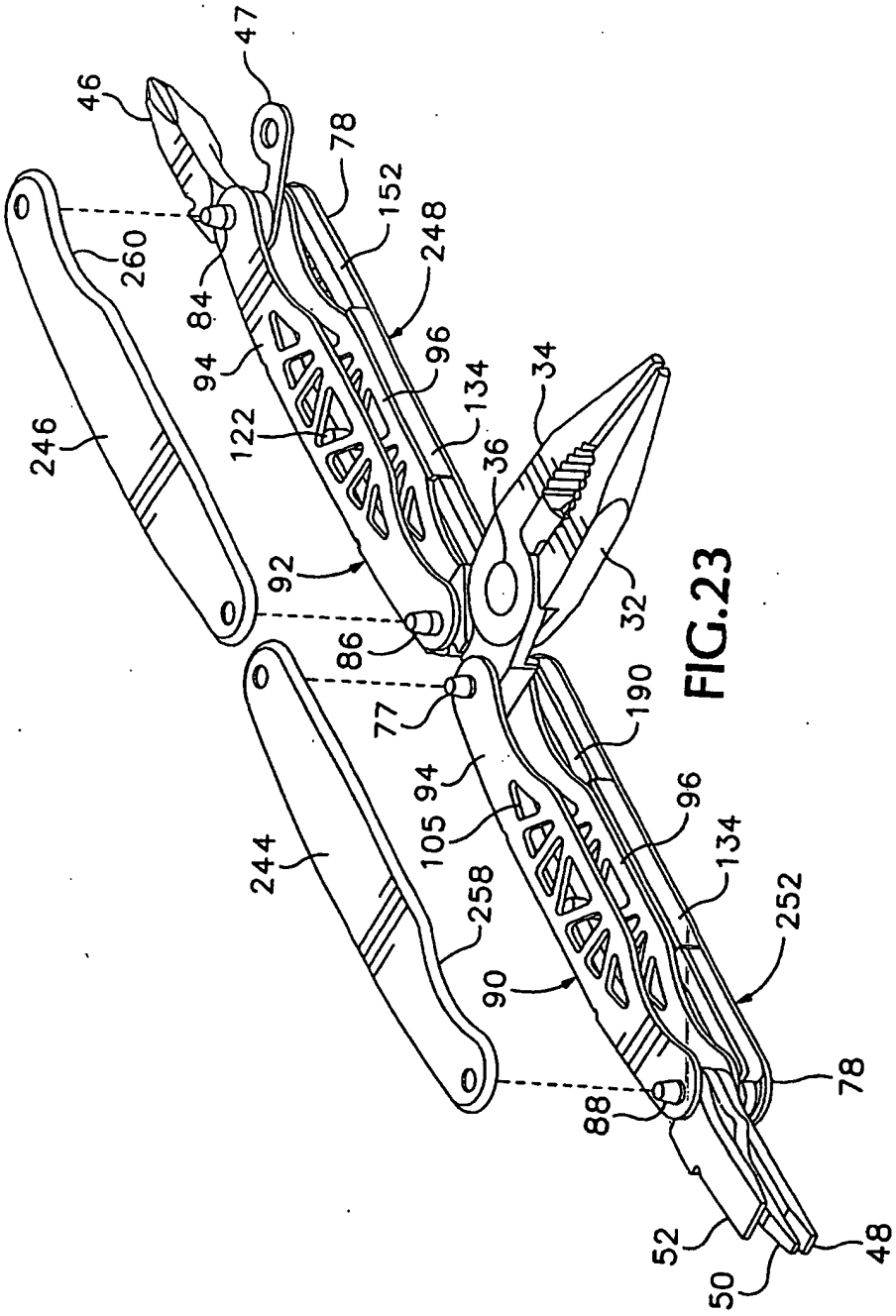
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FIG.23

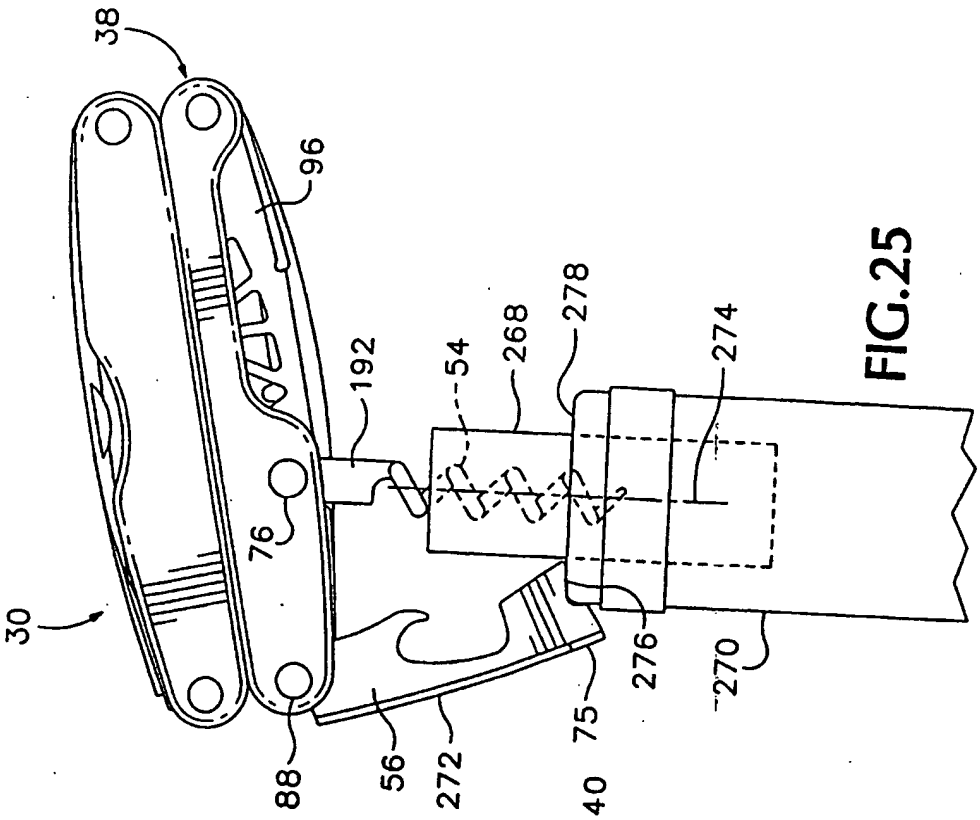
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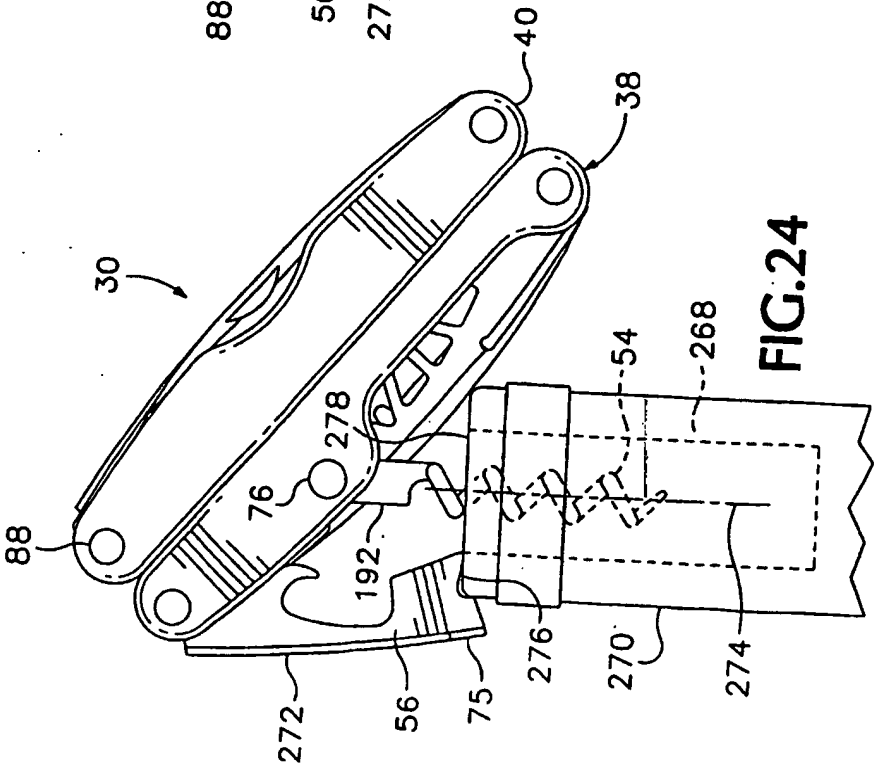
FIG.25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274

FIG.24